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# THE LARYNGOSCOPE.

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VOL. LXII

JUNE, 1952.

No. 6

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## SYMPOSIUM:

### SURGICAL TREATMENT OF HYDROPS OF THE LABYRINTH.

#### (a) — SURGICAL DESTRUCTION OF THE LABYRINTH FOR MENIERE'S DISEASE.\*

KENNETH M. DAY, M.D.,  
Pittsburgh, Pa.

Ménière's disease or endolymphatic hydrops is a distinct pathologic and clinical entity characterized by a distention of the endolymphatic labyrinth. It is generally accepted that this disorder is caused by an autonomic dysfunction affecting the capillary loops of the stria vascularis.

It cannot be stressed too strongly that Ménière's syndrome and Ménière's disease are not synonymous. There is a prevalent tendency among physicians to make a diagnosis of Ménière's disease in all cases having labyrinthine vertigo of uncertain origin whether or not there is an associated deafness and tinnitus. An analysis of the cochlear symptoms usually is neglected even though it is by this means that one can make an accurate and sure diagnosis; in fact, a diagnosis of Ménière's disease should be made from the cochlear symptoms alone, and, if this be done and treatment instituted early, the hydropic condition often can be controlled and vestibular involvement prevented. This is of considerable impor-

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\*Read as part of a Symposium at the Fifty-sixth Annual Meeting of the American Laryngological, Rhinological and Otological Society, Inc., Toronto, Ontario, May 21, 1952.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, May 26, 1952.

tance since signs of cochlear distention often will precede the vestibular signs by months or years. In a review of 220 case histories reported by me<sup>3</sup> two years ago there were only five cases with a history of attacks of vertigo preceding the onset of hearing disturbances.

Spasm of the utricular branch of the internal auditory artery might cause acute vertiginous attacks, but I question whether changes in the volume of endolymph would occur as a result of this reaction. I have yet to recognize a case of this type with acute attacks of vertigo and no cochlear symptoms which on subsequent examination has shown the appearance of cochlear symptoms. This is contrary to Dandy's report of cases of what he called pseudo-Ménière's disease, because no deafness or tinnitus were present. That an occasional case of this type might occur, I do not deny, but I believe it must be rare.

The inability of conservative treatment to relieve or control the symptoms of Ménière's disease in many cases makes consideration of surgical intervention necessary. As a general rule the longer the duration of symptoms and the greater the endolymphatic distention the less effective will be conservative treatment. The surgical procedures under consideration in this symposium include surgical destruction of the labyrinth, partial or total section of the VIIIth cranial nerve and surgical drainage or ablation of the endolymphatic sac.

My own personal experience is limited to surgery of the labyrinth. I have not attempted to operate upon the endolymphatic sac because of the frequency of recurrence of symptoms in cases operated upon by some of my confreres. It was because of dissatisfaction over the results of nerve section that George Wright, who was Professor of Neurology at the University of Pittsburgh, suggested to me, in 1939, that surgery of the labyrinth should be given a trial for Ménière's disease. In view of the pathologic findings of an endolymphatic distention of the labyrinth, as reported by Hallpike and Cairns<sup>4</sup> in the preceding year, this seemed to be the logical point of attack.

Imbued with the idea of trying to destroy the vestibular mechanism without sacrificing hearing, I attempted to do a differential electrocoagulation of the vestibular contents without destroying the saccule or damaging the cochlea. I was successful in preserving cochlear function in 16 of the first 54 cases upon which I operated (see Fig. 1) This may sound like a fine achievement but, actually, these patients were none too happy over the results. Four cases had a recurrence of vertigo, including two in which hearing had been preserved,

Fig. 1. Analysis of 16 cases in which hearing was preserved following operation.

CASE NO.	YEAR	HEARING	TINNITUS		VERTIGO	COMMENTS
			L.P.	H.P.		
2	1941	UNCHANGED 3 YRS. 1946 GRADUAL LOSS	LESS	-	-	
3	1942	IMPROVED 4 YRS.	LESS	-	-	LAST RECORD 17 MOS. BEFORE DEATH PATH. SECTIONS REPORTED (DAY AND LINDSAY). <sup>4</sup> SEVERE HYDROPS
5	1942	UNCHANGED 2 YRS. THEN GRADUAL LOSS	-	H		
11	1944	UNCHANGED 3 YRS. THEN GRADUAL LOSS COMPLETE LOSS 6 YRS.	LESS	-	-	
15	3/45	UNCHANGED 3 1/2 YRS. THEN DISTORTION, GRAD. LOSS IMPROVED 1 YR.	LESS	-		
18	6/45	THEN RAPID LOSS AND DISTORTION	H	-	-	USED TELEPHONE ON AFFECTED EAR REVISION BECAUSE OF COCHLEAR SYMPTOMS
26	2/47	IMPROVED 7 MOS. FLUCTUATED WITH CHANGE IN WEATHER	LESS	-		USED TELEPHONE ON AFFECTED EAR NO RECORDS AFTER 7 MOS. P.O.
39	11/47	UNCHANGED 1 YR. SOME DISTORTION	SAME	-		COULD USE TELEPHONE ON AFFECTED EAR
41	1/48	IMPROVED 4 YRS. SOME DISTORTION DISCRIMINATION SCORE 78%	LESS	-		COULD HEAR WATCH TICK AND USE TELEPHONE
44	3/48	5 MOS. UNCHANGED	WORSE	-	RECURRENCE 5 MOS. P.O.	REVISION: COMPLETE RELIEF HEARING LOST
46	3/48	UNCHANGED 2 YRS. FLUCTUATION DISCRIMINATION SCORE 94%	SAME	-	RECURRENCE 2 YRS. P.O.	REVISION: WITH RELIEF OF VERTIGO HEARING LOST
48	5/48	LESS DISTORTED	LESS			
50	9/48	UNCHANGED 6 MOS. THEN WORSE D.S. 6 MOS. 78%, 9 MOS. 58%	WORSE			REVISION: BECAUSE OF DISTORTION AND ROAR, TINNITUS L.P.- H.P. $\frac{1}{2}$ HEARING LOST
51	10/48	IMPROVED TO NORMAL LIMITS D.S. 1 1/2 YRS. 80%-34 YRS. 80% FUZZY IN DAMP WEATHER	LESS			
52	11/48	GRADUAL LOSS 2 YRS. DISTORTION D.S. 6 MOS. 32%	SAME			
54	1/49	1 YR. UNCHANGED RECRUITMENT $\frac{1}{2}$ D.S. 3 MOS. 55% D.S. 3 YRS. 40%	0			HEARS WATCH TICK

Fig. 1. Analysis of 16 cases in which hearing was preserved following operation.

evidently due to incomplete destruction of the vestibular labyrinth. Revisions to complete the destruction were done successfully in these four cases. Revisions were done also on two other cases because of continued roaring tinnitus and distorted hearing, although they already were completely free of vertigo. In only four cases could I demonstrate practical hearing for speech maintained for more than two years following operation. The majority of cases continued to have loud, roaring tinnitus and distortion of hearing with deafness gradually increasing over a period of years.

It finally dawned upon me that I was really doing these patients a disservice by attempting to preserve the hearing of the affected ear. It was largely as a result of the follow-up study of this series of cases that I reached a full appreciation of the significance and severity of the cochlear symptoms of Ménière's disease. Whether hearing is preserved by differential nerve section or differential electrocoagulation the result should be the same. There remains a distended cochlear duct with its associated disagreeable symptoms of diplacusis, distortion and roaring tinnitus. The exception to this rule will be the occasional case with improved hearing and subsidence of symptoms due to the shock effect of surgery causing a correction of the autonomic dysfunction and a remission of symptoms which may be temporary or permanent. This would be analogous to the occasional effect of such surgery as tonsillectomy upon hay fever or vasomotor rhinitis. I hope that during this symposium we may hear more about the actual hearing ability of the affected ear following differential nerve section or ablation of the endolymphatic sac. Pure tone audiometry does not give this information. The difficulty in understanding speech is out of all proportion to the threshold hearing loss. Discrimination scores will show this clearly (see Fig. 2). The combination of roaring tinnitus, distortion of hearing and severe recruitment results in extremely poor ability to understand conversational speech.

I abandoned the procedure of differential electrocoagulation three and one-half years ago and now do a labyrinthectomy with destruction of both the cochlear and vestibular mechan-

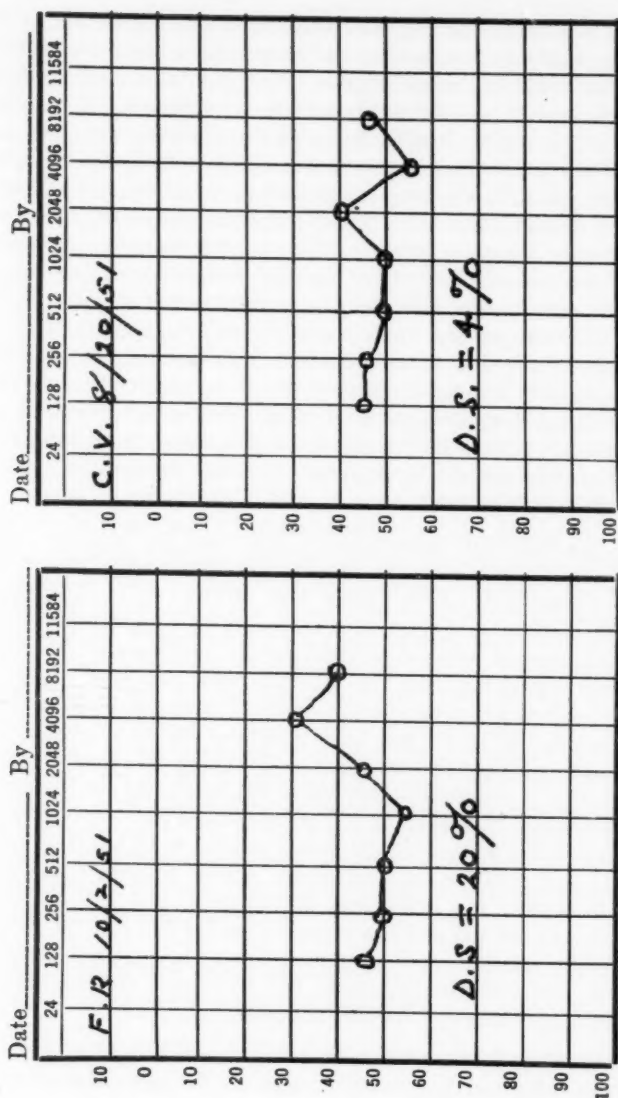


Fig. 2. Typical audiograms of two cases of Ménière's disease with discrimination scores showing inaccuracy of pure tone audiometry as an index of ability to understand speech.

isms. The labyrinth can be destroyed effectively by the Cawthorne method of removing the membranous horizontal semicircular canal or by passing a barbed dental broach or fine curette into the vestibule to remove its contents. I, personally, use a dental broach followed by a needle electrode to coagulate the sensory nerve endings in the vestibule, because I believe that this procedure insures a smoother and shorter period of convalescence. I do not advise the employment of the needle electrode by the inexperienced surgeon, as there have been several reports of facial paralysis occurring after its improper usage. The membranous labyrinth is not as delicate an organ as one would expect. Unless a portion of it is actually removed at operation there is a possibility of residual function persisting after operation. The continuation or return of roaring, low-pitched tinnitus following operation is indicative of incomplete cochlear destruction. Recurrence of dizzy spells suggests incomplete vestibular destruction and a revision is indicated.

If one labyrinth is completely destroyed the question will immediately arise as to the danger of involvement of the other ear. Fortunately, this occurs but rarely. It is true that Ménière's disease may involve both ears in about 10 per cent of the cases but, when this does happen, both ears are usually affected simultaneously. Of the 220 case histories which I analyzed two years ago<sup>3</sup> there were 27 cases of bilateral involvement, but in all but four instances the involvement of both ears occurred simultaneously. In the series of cases upon which I have operated to date there has been only one instance of subsequent involvement of the unaffected ear. In this case the symptoms were confined to the cochlea with hearing loss, low-pitched tinnitus and distortion. Under prompt conservative treatment the symptoms disappeared, and the hearing returned to normal and has remained so for the past year. In bilaterally affected cases surgery seems to be contraindicated. If other conservative measures fail to control the condition, streptomycin therapy should be considered.

I have gone into considerable detail about the undesirability of preserving cochlear function because the advocates of dif-

ferential nerve section use the preservation of cochlear function as their main argument in claiming nerve section to be the operation of choice for Ménière's disease. Aside from the questionable desirability of preserving hearing in the affected ear the nerve section operation has little to offer in its favor. It seems illogical to perform an intracranial operation which entails the opening of the arachnoid space when the peripheral organ can be attacked more easily and with greater safety. Surgery of the VIIIth nerve is a major undertaking with a significant mortality rate aside from Dandy's unequaled record. Complications and undesirable side effects are not uncommon, especially damage to adjacent cranial nerves. Little discussion has been given of these factors in the literature. In Dandy's<sup>2</sup> report to the American College of Surgeons, he concluded, "I know that (the) operation cures the disease with almost no risk and with no side effects." Yet, in a recent report of Dandy's series, Green and Douglas<sup>3</sup> state that the most important complication was facial paralysis; of 408 cases undergoing partial or complete nerve section, 54, or 13.2 per cent, developed facial paralysis which remained complete in over 4 per cent; in fact, with complete section facial paralysis occurred in 25 per cent. Dandy himself admitted that approximately 10 per cent of his cases showed recurrences when partial nerve section was performed. This is to be expected since pathologic studies by Rasmussen<sup>4</sup> have shown that as much as one-fifth of the cochlear nerve may be occupied by vestibular fibres. Putnam<sup>5</sup> stated that the procedure of VIIIth nerve section is not always as easy, rapid and safe as some accounts would lead us to believe and he attempted a simpler procedure by exposing the superior semicircular canal through a subtemporal decompression. Through a trephine opening into the canal he passed a needle and coagulated the vestibular contents with indifferent success.

In deciding the operation of choice for Ménière's disease, the following questions need an answer:

1. The effectiveness of the procedure in terminating or relieving the symptoms.

2. The surgical risks involved.
3. The frequency of complications and unfavorable side reactions.
4. The simplicity of the procedure.
5. The length of time required for recovery and rehabilitation.

My answers are:

1. Labyrinthectomy is completely effective in terminating the attacks of vertigo in unilateral Ménière's disease. It also relieves distressing cochlear symptoms at the expense of destroying hearing which already is of little or no use.
2. Surgical risks are minimal with labyrinth surgery. I have heard of only one fatality from a brain abscess.
3. The only complications in my series of 94 operations were two simple hematomas, one of which required evacuation. Cawthorne<sup>1</sup> reported 159 operations with two postoperative infections as the only complications in his series.
4. Labyrinthectomy by way of a mastoid antrotomy, using either an endaural or postauricular approach, is a relatively simple procedure with a minimum of surgical shock. The operation can be completed comfortably in 30 minutes. I have operated several cases over 70 years of age and one case over 80.
5. Hospitalization usually is limited to seven or eight days and the average case is back to work within three weeks following labyrinthectomy.

For the above reasons labyrinthectomy is the operation of choice for this condition.



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SYMPOSIUM:  
SURGICAL TREATMENT OF HYDROPS OF THE  
LABYRINTH.

(b) — THE PORTMANN OPERATION.\*

MR. ROBERT L. FLETT (by invitation),  
Derby, Engand.

In 1927, Portmann advocated opening the saccus endolymphaticus for Ménière's disease and claimed good results from this. At this time Guild also described the saccus, dividing into three parts: proximal, intermediate and distal, the intermediate part being surrounded by connective tissue. In a later paper he related his discovery, using the Prussian blue technique, that endolymph was absorbed in that area. In 1938, Hallpike described the microscopical appearances of the membranous labyrinth and saccus in Ménière's disease and suggested that the changes might be due to lessened absorption of endolymph in the intermediate part. Woodman and Stirk Adams, in 1939, reported 10 cases in which they had performed the Portmann operation, nine of them with striking results.

I became more interested in this method of treatment when, in 1939, a miner reported with very severe symptoms of giddiness and deafness in his left ear, the only good ear. In 1908, his right ear had undergone a very radical mastoid operation for lateral sinus thrombosis and ligature of the internal jugular vein, and the result was total facial paralysis and total labyrinthine deafness. All investigations regarding Eustachian obstruction, sinusitis, water and salt metabolism, etc., were negative, and during this time of waiting he became very impatient. He worked on the coal face, and every time

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he had an attack he had to be carried to the pit bottom, and during this journey of two miles his mates' remarks often became somewhat cutting. They had already carried him six times and swore they would not do it again. He wondered if some operation could be done without deafening his left ear any further. I, therefore, admitted him to the hospital without delay and performed the Portmann operation. The result was most striking; as soon as he recovered from the anesthetic, the giddiness and tinnitus had disappeared, and the hearing was almost normal through the bandages. To me, this was too good to be true; however, I saw him two months ago and the condition of his left ear was normal. Since then I have had to do this in 60 cases. This may seem rather wholesale, but not out of a hospital population of half a million with a conservative estimate of 150 cases of aural vertigo per year. Prewar there was a smaller number of cases, but they seemed to be more severe than those we are seeing now. We carried out routine investigations and treatment and these 61 cases are those which showed no response and which were so severe that something must be done; indeed, apart from the case quoted, and one other, I was prepared to proceed to labyrinthine destruction.

The other case was similar to the first. The right ear was totally deaf, due to a labyrinthitis during diphtheria in childhood. Then, in 1941, a left Portmann operation was performed with immediate restoration to normal. Three years later the symptoms recurred, and the patient demanded that the operation be redone. Again she improved just as much, but recurrence took place one year later. Operation for the third time then produced no change.

The operation is performed through the postaural mastoid incision, and the mastoid opened in order to expose the lateral sinus. By blunt dissector and fine curette, the cerebellar dura medial to this is lifted from the posterior surface of the temporal bone. On the average skull the distance from the lateral sinus to the sacculus is about 1 cm., but it may be necessary to go medially for 1.5 cm. This should not be exceeded, as the internal auditory meatus is only 2 cm. away. Lately

I have been accustomed to work through a small opening in the lateral sinus plate and to take away bone from behind the posterior semicircular canal. This, I think, makes it more certain that the sacculus under its shelf of bone will be opened. It is seldom seen, and sometimes the dura is opened at that point. At times the hemorrhage is so brisk from emissary veins that the wound may require packing for two days before proceeding further. The mastoid antrum is opened and the bony external semicircular canal exposed, in case labyrinth destruction is required. The wound is sutured with no drain. Any case that shows no immediate improvement is reopened in one week's time and the labyrinth destroyed.

#### RESULTS — 61 PATIENTS.

Postoperative deaths, two. 1. Meningitis. 2. Bronchopneumonia.

Immediate failures, eight. Destruction of labyrinth one week later.

One wrong diagnosis. Epileptic aura (this diagnosis was made after six years).

Fourteen cases with perfect result.

Thirty-six cases with some improvement.

#### 36 CASES WITH SOME IMPROVEMENT.

*Giddiness*: Disappeared, 21; improved, 12; no improvement, three.

*Tinnitus*: None, 11; slight or used to it, seven; colds cause buzzing, two; bad, eight.

*Deafness*: Normal hearing, six; no improvement or worse, 30 — 50 to 70 db loss, and of these, nine have hearing aids.

The results can be seen in Table I. There were 61 cases in 10 years up to June, 1949, and two and one-half years have been allowed for follow-up from then; 26 cases occurred on the right side and 35 on the left.

The operation is not without danger as there were two postoperative deaths: one from meningitis — streptococcal in type, in a case that had to be opened twice, owing to hemorrhage the first time; the second case died of bronchopneumonia five days after the operation. There were eight immediate failures, and these required destruction of the labyrinth one week later. There was one which I may term a wrong diagnosis; she was not improved at all, and it took us and the neurological physicians six years to decide that this was due to an epileptic aura of the *petit mal* type. There were 14 cases with a perfect result; that is, the hearing showing only 10 db loss over the speech range with slightly increased higher tone loss. The remaining 36 cases showed some improvement. I shall now analyze these 36 cases.

*Giddiness:* Disappeared in 21, improved in 12, and showed no improvement in three, and really these three cases should have their labyrinths destroyed. The tinnitus had disappeared in 11; seven cases complained of slight tinnitus or had become accustomed to it; colds caused buzzing in two, and eight complained of severe tinnitus, as, for example: like a bomb whistling down. Heavy work, especially moving the right arm, causes the palpitation to go to the right ear. I also saw two cases where the tinnitus was almost unbearable. I have had some of these show delay in improvement in the noises, or noises may come on again in three months' time and may later, for no apparent reason, disappear.

*Hearing:* Six of these cases showed hearing loss up to 10 db over the speech range, and I have designated these as normal. The remaining 30 show no improvement or have become worse, that is, 50 to 70 db loss, and of these, nine have hearing aids. I shall further discuss the giddiness in those cases which have improved:

1. Complained of slight giddiness in 1950, 10 years after the operation, but before the operation he had severe giddiness with vomiting and diarrhea and has not been absent from work since.

2. Had two attacks in 10 years, was off work once for five weeks and another time for two weeks.
3. Complained of slight giddiness with colds, but could carry on his work.
4. Becomes slightly lightheaded with noises at times.
5. Eight years after the operation had one attack of giddiness. He was operated upon at the age of 15.
6. Is aged 71 and complains of slight giddiness when doing too much work, especially with the arm upward.
7. Had one short attack eight years later, but none since.
8. Has been off work one month, eight years after the operation, but the attack was much less severe.
9. Complained of slight giddiness on turning over in bed or stooping suddenly.
10. Is a miner who complains of slight giddiness on walking in the dark, especially in the coal pit.
11. Three years after the operation complained of slight giddiness.
12. Complained of a feeling of general swimminess with no bouts of giddiness.

In these cases there was sometimes a delay in improvement up to one year and, indeed, two of them during this time were put on the waiting list for destruction of the labyrinth, but later reported, saying that they did not wish to have the operation as they were much better.

The giddiness has been investigated by caloric test in only one. This was a patient who had had a good result and she was so upset to find that she could become giddy again that, notwithstanding my explanations of this, she continued giddy for another two months, and I have, therefore, not performed it on any of the other patients.

Except for 11 patients, the results concerning giddiness, show that there is still some place for the Portmann operation; however, it may be argued that with the deafness now up to 50 to 70 db loss in 30 of these patients, the progress regarding giddiness is somewhat like the normal progress of Ménière's disease without treatment, *i.e.*, normal progress cut short, and also that no definite benefit has been obtained. Even if this is the case, there are only three cases which show severe giddiness in attacks, and as can be seen from the 12 cases that have been considered as only improved, all of these have been able to continue with their work over periods of years without interruption.

I have performed no destruction of the labyrinth since 1947.

**SYMPOSIUM:**  
**SURGICAL TREATMENT OF HYDROPS OF THE**  
**LABYRINTH.**

**(c) — THE RESIDUAL HEARING FOLLOWING**  
**PARTIAL RESECTION OF THE VIIIth NERVE.\***

K. G. MCKENZIE, M.D. (by invitation),  
Toronto, Ontario.

It is my hope that a follow-up report on patients submitted to intracranial section of the vestibular nerve at the Toronto General Hospital will be of interest and value in this symposium on "Hydrops of the Internal Ear." The follow-up has been carried out by Dr. Barber and Dr. Ireland, and they will submit their findings in the next paper. My following brief remarks may be looked upon as an introduction to their factual paper.

To begin with, my interest in this subject goes back many years. I recall clearly the time in 1930 when McGregor and I obtained a fresh autopsy specimen of the petrous bone with the intracranial VIIIth nerve intact. We took this to a dentist's office and, using his drill and good light, we spent several satisfactory hours laying bare the nerve in the canal up to the internal ear. In this situation the nerve could be seen in two distinct portions: one vestibular and the other cochlear. By gross dissection we could separate the nerve down to its intracranial portion. Just internal to the internal auditory meatus it was obvious that the vestibular nerve was the most superficial half of the VIIIth nerve. The cochlear portion was deepest and the facial nerve was in close approximation to the deepest or cochlear portion. This relationship is of some interest to surgeons, because the vestibular portion can be

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split off at the internal meatus and cut without disturbing the facial nerve; in fact, there is much less chance of traumatizing the facial nerve by cutting only the vestibular portion than there is by section of the whole nerve. In all, Dr. Botterell and I have cut the vestibular nerve intracranially in some 117 patients and temporary facial paralysis has been a complication in only one case.

Another observation that Dr. McGregor and I made on the specimen interested us greatly. Microscopic study of the vestibular and cochlear nerves showed that they had quite a different appearance. The vestibular fibres were much larger and coarser than the cochlear fibres. Just medial to the internal auditory meatus where the surgeon splits off the vestibular portion there was some mingling of fibres. Obviously in this specimen if the nerve is not split approximately in its middle the most easily accessible half would consist almost entirely of vestibular fibres. At that time we could find no reference in anatomical or histological texts describing this microscopic difference in two halves of the VIIIth nerve. It was such a simple observation that I am sure others had noted it before, and it does not seem possible that it could have been original with McGregor and myself. Since then, Rasmussen (*THE LARYNGOSCOPE*, Vol. 50, pp. 67-83, 1940) has confirmed the observation. I would appreciate information from any member of this audience on any earlier observations on this point. Our findings were reported and filed in the *Transactions of the Toronto Academy* in 1932, where we also recorded the first cases operated upon by section of the vestibular nerve, leaving the cochlear portion intact. All this is a matter of local background, and I thought it might interest you.

Through the years I have operated upon a large number of cases, and on the whole the patients were grateful and well-pleased with the results. As the years went on and more was known about the disease and its natural course, I found myself operating upon a smaller percentage of patients. It was possible to have a frank talk with many and persuade them to accept a few severe spinning attacks a year with equanimity.

ity. They were prepared to do this when told firmly that the symptom did not indicate the presence or development of any serious disease or growth; the attacks, although alarming, would never endanger their lives; the disease usually ran an up and down course with periods of freedom from attacks for months at a time and, in the end, over a variable period of years, would probably cease. It was made clear that the operation could be done at any time if they were the unusual case that had sufficient attacks to make life altogether miserable and economically unsound. Finally, they were informed that no medicine or special diet was of any value. It always seemed to me that the sound psychological handling of such a patient is weakened by prescribing medicine, as the patient could then justifiably feel that the right doctor and right medicine would stop the attacks, and commence wandering from doctor to doctor, in danger of becoming emotionally upset and ceasing to be a productive citizen. I did have a few patients put on a rigid salt-free diet but finally concluded that the diet was worse than the disease, particularly as I could not satisfy myself that it was of any real value in lessening attacks.

This gradually increasing conservative viewpoint has resulted in fewer operations on patients with Ménière's syndrome on the neurosurgical service at the Toronto General Hospital during recent years. I realize, however, that there is another reason for fewer operations by the intracranial approach. My colleagues, the otologists, have now largely taken over the surgical treatment of the disease with their operation of destruction of the labyrinth. I have not had sufficient experience with this operation to compare it satisfactorily to the intracranial procedure. Mortality should be minimal in both procedures; we have had two deaths in 117 cases. I know of one death in this Center from cerebellar brain abscess secondary to destruction of the labyrinth. I believe you will agree after reading the paper by Dr. Ireland and Dr. Barber that our results from the standpoint of cure of attacks have on the whole been very satisfactory. Preservation of useful conversational hearing for long periods of

years in patients with good hearing before operation has been worthwhile. Intracranial vestibular section would definitely be the operation of choice in a patient deaf from middle ear disease or some other cause in the unaffected ear.

I would caution otologists and physicians to adopt a conservative approach. Adequate and straightforward advice will enable many of these patients to accept their attacks with equanimity. Not too many require surgical treatment.

Are you in this group really prepared to accept the pathological evidence that these patients have edema of the internal ear? I have some nostalgic feeling regarding the term Ménière's syndrome being replaced by "hydrops of the internal ear." Ménière's syndrome has meant a good deal in a clinical way through the years and the term "hydrop" will, I believe, require modification when more is known about this disease which causes severe spinning attacks and typically is associated with noise in one ear and some progressive deafness most marked in that ear in which the noise is heard by the patient. The disease cannot be entirely confined to the internal ear; if this were true, complete section of the VIIIth nerve would stop the noise in the ear. We know that this happens in only a few cases.

Finally, speaking as a neurosurgeon, I wish my otologist colleagues good luck with their operation of destruction of the labyrinth. Long term follow-up of the results in this operation will be needed for satisfactory comparison with intracranial section of the vestibular nerve,—an operation that has remained highly satisfactory in properly selected cases over a period of some 20 years.

Medical Arts Building.

**SYMPOSIUM:**  
**SURGICAL TREATMENT OF HYDROPS OF THE**  
**LABYRINTH.**

**(d) — THE CLINICAL RESULTS FOLLOWING**  
**DIFFERENTIAL SECTION OF THE VIIIth NERVE.\*†**

H. O. BARBER, M.D.§ (by invitation),

and

P. E. IRELAND, M.D.,  
Toronto, Canada.

The original complete section of the VIIIth nerve by the intracranial route, as introduced by Dandy,<sup>1</sup> was a distinct advance in the relief of the symptoms of labyrinthine hydrops. An attempt to improve this procedure was first made by McKenzie,<sup>2</sup> of Toronto, by the differential section of the vestibular fibres at their exit from the internal auditory meatus. This report concerns a review of available cases which were operated upon by this method during the 20 years from 1931 to 1951. During this time, 117 patients were operated upon by the neurosurgical service of the Toronto General Hospital, with close cooperation from the department of otolaryngology in the clinical assessment. In this group of cases, two died in the immediate postoperative period and five have died subsequently of unrelated causes. There were also seven patients who, for various reasons, had complete section of the VIIIth nerve. With this exclusion, there remain 103 patients with section of the vestibular portion of the VIIIth nerve, of whom 53 have returned for re-examination during 1951 and 1952.

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†From the Departments of Otolaryngology and Neurosurgery, University of Toronto.

§E. P. Taylor Fellow in Otolaryngology.

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The purpose of this paper is to report on the long-term, clinical progress of these patients. The follow-up examination has been conducted with the purpose of tracing the course of the main triad of characteristic symptoms of this disease, but with particular reference to the residual hearing which has been retained.

In reviewing each patient, a careful interim history was taken. The hearing was tested by a pure tone audiometer, usually the Maico E-2 type. The audiograms obtained were arbitrarily divided into three groups, namely:

1. "Useful hearing"—with average loss in frequencies 500 to 2,000 c.p.s. (inclusive) of less than 50 db.
2. "Borderline hearing"—with average loss in frequencies 500 to 2,000 c.p.s. (inclusive) of 50 to 55 db.
3. "Hearing of no value"—with average loss in frequencies 500 to 2,000 c.p.s. (inclusive) of greater than 60 db.

In addition to this, all patients with "useful" or "borderline" hearing were examined by recorded speech and masked conversational voice. This was done in an attempt to determine if any discrepancy existed between the speech reception threshold (SRT) and reception of pure tones.

The technique adopted for testing labyrinthine function was that of massive caloric stimulation with water at 50° F. A labyrinth was considered dead if no response resulted from five minutes' stimulation by this method.

It was also considered that the subjective opinion of the patient on whom intracranial section had been performed might be of importance both from the standpoints of hearing and relief of the original symptoms. In this regard, a detailed history was taken as to relief of vertigo and tinnitus and also the ability to continue in a normal vocation.

TABLE 1.  
DIFFERENTIAL SECTION VIIIth NERVE.

Total number of patients considered.....	103
Sex:	
Male .....	73
Female .....	30
Age when operation performed:	
Youngest .....	19 years
Oldest .....	64 years
Mean .....	46.9 years

From this investigation, it is apparent that hydrops of the labyrinth is largely a disease of middle age. The predominance of males over females might be explained on an economic basis. This indicates only that the question of the need for surgical intervention is decided mainly on the ability of the individual to continue in his useful sphere in life. The problem naturally occurs more frequently in the breadwinner.

TABLE 2.

Group I (10 to 20 years' follow-up).....	16 patients
Group II (5 to 10 years' follow-up).....	19 patients
Group III (0 to 5 years' follow-up).....	18 patients
Total.....	53 patients
Shortest follow-up .....	3 months
Longest follow-up .....	20 years
Mean follow-up .....	7.70 years

From this table, it will be seen that the 53 patients who were examined have been divided into three groups which depend on the period elapsed since the operation was performed. These are shown at this time only because they have significance in a later consideration of our findings.

## TRIAD OF SYMPTOMS.

## A — VERTIGO.

TABLE 3.

DIFFERENTIAL SECTION VIIIth NERVE  
VERTIGO.

Totally relieved (44 patients).....	83.0 per cent
Partially relieved (two patients).....	3.8 per cent
Not relieved (seven patients).....	13.2 per cent

The relief of this symptom has presented one of the most controversial subjects in any surgical procedure for hydrops of the labyrinth. The figure (87.7 per cent) presented by Green and Douglass<sup>3</sup> on Dandy's cases is in essential agreement with our own.

Referring again to Table 3, it is seen that seven patients (13.2 per cent) were not relieved. Of this number, four had developed involvement of the unoperated ear, after a period of freedom from vertigo lasting from two to 16 years, with a mean average of 9.7 years. One failure was due to inadequate division of the vestibular fibres as indicated by an active caloric response at the time of survey. The remaining two patients had been incorrectly assessed preoperatively and were eventually disabled by psychogenic illness.

Two patients were only partially relieved; one stated that his attacks were much less severe, and the other was found to have severe cardiovascular-pulmonary disease to which his residual symptoms were attributed.

TABLE 4.  
DIFFERENTIAL SECTION VIIIth NERVE  
TINNITUS.

Number of patients examined .....	53
Tinnitus absent (four patients).....	7.6 per cent
Tinnitus improved (18 patients) .....	33.9 per cent
Tinnitus unchanged (17 patients).....	32.0 per cent
Tinnitus increased (14 patients).....	26.5 per cent

It may be seen from Table 4 that a very small number of patients were completely relieved of this subjective symptom. If we add a further group who stated that the tinnitus was improved, we obtain a more favorable figure (41.5 per cent), comparable to that of Green and Douglass<sup>3</sup> (36.9 per cent). The last two groups, in which the symptom was unchanged or increased, form a disappointing percentage of failures (58.5 per cent). In spite of this, one found, on questioning these individuals, that very few complained of their tinnitus. Almost invariably they had adjusted themselves to its presence and found it did not interfere with their daily routine. Two exceptions to this were individuals who had inadequate personalities.

TABLE 5.  
DIFFERENTIAL SECTION VIIIth NERVE  
TINNITUS.

Group I (10 to 20 years' follow-up—16 patients).....	(a) absent	0
	(b) improved	6
	(c) unchanged	5
	(d) increased	5
Group II (5 to 10 years' follow-up—19 patients).....	(a) absent	1
	(b) improved	4
	(c) unchanged	8
	(d) increased	6
Group III (0 to 5 years' follow-up—18 patients).....	(a) absent	3
	(b) improved	8
	(c) unchanged	4
	(d) increased	3

It is evident from this grouping that the patients more recently operated upon (Group III) had the largest percentage of improvement and complete relief. In Group I (10 to 20 years' follow-up), no patients were completely relieved of the symptom. Of this group, three complained bitterly of noise, and all showed involvement of the other ear. Although no explanation for these findings is available, it is possible that they may be due to mere statistical chance.



*C — HEARING.**1. The Testing of Hearing by Pure Tone Audiometry.*

This method of examination was chosen because it provided a known standardization of hearing loss which could be compared with preoperative records.

TABLE 6.  
DIFFERENTIAL SECTION VIIIth NERVE  
RESIDUAL HEARING.

Number of patients examined.....	53
Hearing useful (14 patients).....	26.4 per cent
Hearing borderline (two patients).....	3.8 per cent
Hearing of no value (37 patients).....	69.8 per cent
CRITERIA USED.....	Useful—less than 50 db loss
	Borderline—50 to 55 db loss
	No value—over 60 db loss
TEST RANGE.....	50 to 2,000 c.p.s., inclusive

From Table 6 it may be seen that an arbitrary figure of 50 db was chosen as the critical level for hearing loss by pure tones. This was used for various reasons, but chiefly because it was felt that at this level, either with or without a hearing aid, a patient could continue as a useful citizen even in the event of complete deafness in the other ear. The test range selected was the commonly accepted conversational range of 500 to 2,000 c.p.s., inclusive.

TABLE 7.  
DIFFERENTIAL SECTION VIIIth NERVE  
RESIDUAL HEARING.

Group I (10 to 20 years—16 patients).....	(a) useful 1
	(b) borderline 0
	(c) no value 15
	(3 bilateral)
Group II (5 to 10 years—19 patients).....	(a) useful 4
	(b) borderline 2
	(c) no value 13
	(1 bilateral)
Group III (0 to 5 years—18 patients).....	(a) useful 9
	(b) borderline 0
	(c) no value 9
	(1 bilateral)

Table 7 shows that the patients with retention of useful hearing fall largely into Group III (0 to 5 years' follow-up). This finding, coupled with the small number of patients with useful hearing in the longer follow-up periods (Groups II and I), indicates that deterioration does occur with the passing of years. When the 10-year postoperative period has been reached, retention of useful hearing is very unlikely. The only patient left with useful hearing in this group had had an incomplete operation, as indicated by an active response to caloric testing at time of survey.

This long-term failure of hearing might well be explained by the progressive nature of the disease in the labyrinth. It is most interesting that two patients had improved and useful levels of hearing by pure tone following the operation. Both were completely relieved of vertigo, but both showed an active caloric response.

## 2. *The Testing of Hearing by Recorded Speech Reception.*

This method of examination was used only on the patients who were found to have "useful" or "borderline" hearing by pure tone test. It is the ability to carry on conversation with others that is important to an individual, and not to hear a series of pure tones. An important observation in this regard was made, in that, results of the old-fashioned testing by conversational voice with proper masking closely paralleled the findings by recorded speech; however, it was found in some cases that there was considerable discrepancy between the pure-tone threshold and the SRT.

TABLE 8.  
DIFFERENTIAL SECTION VIIIth NERVE  
HEARING.

Group	Hearing "Useful or Borderline" (Audiogram)	SRT Discrepancy	
		Yes	No
Group I (10 to 20 years).....	1	1	0
Group II (5 to 10 years).....	6	2	4
Group III (0 to 5 years).....	9	5	4
Total.....	16	8	8

For purposes of comparison we attempted to establish a differential between these two methods of testing the retained hearing. The term "SRT Discrepancy" has been used to indicate an additional loss of greater than 10 db for recorded speech, over that found by pure tone examination. This provides the additional information that, of the 16 patients in all postoperative periods found to have "useful" or "border-line" hearing, one-half showed a discrepancy when tested with recorded speech. This discrepancy agreed with the results of testing by ordinary conversational voice, as noted above. This did not necessarily mean that these eight patients should be relegated to the "useless" hearing group but only that there was a discrepancy between the two methods of testing (that is, pure tone and recorded speech). In fact, six of those showing a raised threshold for recorded speech still retained a conversational level, with proper masking, varying from three to six feet. These patients were not tested by the "free field" method.

### 3. *The Subjective Hearing Findings.*

A common statement given on re-examination was, "my hearing was the same immediately following the operation and lasted for a number of years, but has gradually slipped away since then." These patients were asked to estimate the period of useful hearing they retained.

TABLE 9.  
DIFFERENTIAL SECTION VIIIth NERVE  
HEARING — SUBJECTIVE FINDINGS.

Group	Total No. of Patients	No. with Useful Postoperative Hearing	Average Period of Useful Hearing	Useless Preoperative or Postoperative
Group I (10 to 20 years).....	15	4	7.5 years	11
Group II (5 to 10 years).....	13	3	3 years	10
Group III (0 to 5 years).....	9	1	1 year	8

This group (37 patients) showed "useless" hearing at examination. neurosurgical service in this survey.

This table indicates that there probably is an extra group who have had a period of useful hearing which did not show at the time of examination. While there is no proof of this statement, it still means that eight additional patients *believed* that they continued to have useful hearing for a varying period of time.

Good preoperative hearing records were available for 24 of the 37 patients examined within 10 years of operation (Groups II and III). Seven had useless hearing preoperatively, and of the remaining 17 with serviceable hearing before surgery, 11 had retained useful hearing for conversation in a normal environment at time of examination, as judged by the standards previously mentioned.

To summarize the findings on hearing: It is fair to state, on the basis of these figures, that hemisection of the VIIIth cranial nerve for labyrinthine hydrops offers the patient about two chances in three (11 in 17) of retaining useful hearing in the operated ear for a varying period up to 10 years. This hearing will deteriorate, and is unlikely to be present after 10 years.

Comparison of our findings on residual hearing with those reported for Dandy's cases is not possible, since the latter were analyzed from a different viewpoint and apparently were not tested for reception of speech.

#### PATIENT'S SUBJECTIVE REACTION TO OPERATION.

Most of these patients were very grateful for the relief they had obtained from their dreaded attacks of dizziness. Such comments as: "made a new life for me," "would rather be dead than the way I was," and "haven't missed a day's work since" were frequently given. Even with severe unilateral deafness and unremitting tinnitus, their enthusiasm for the operation and their surgeon persisted.

## SUMMARY.

The clinical review of this group of patients with the typical triad of symptoms has shown briefly these findings:

1. *Vertigo*. Approximately the same number as quoted in Dandy's series obtained complete relief from this symptom (83.0 per cent).

2. *Tinnitus*. This symptom was improved in 41.5 per cent of cases.

3. *Hearing*. a. In an appreciable number of cases, useful hearing for pure tones was maintained for a limited period. In only one case was this true after 10 postoperative years and this patient showed a still-active caloric response.

b. Half of the group which showed useful levels by pure tone test were found to have a significant discrepancy in their reception of recorded speech. This proves that the final assessment of retained hearing must not be by pure tone audiometry alone.

4. *Subjective reaction*. Eighty-five per cent of the patients were enthusiastic or pleased with this operative procedure, and five patients (9.4 per cent) had failure due to development of hydrops in the unoperated side. From history, the group of 15 patients operated upon from 10 to 20 years ago, stated in four instances that they had useful postoperative hearing which was retained for an average of seven and one-half years.

## CONCLUSIONS.

1. The postoperative results of differential section of the VIIIth nerve have been discussed.

2. This operation is very satisfactory for the rehabilitation and relief of the patient suffering from the symptoms of severe vertigo in hydrops of the labyrinth.

3. Improvement in the symptom of tinnitus cannot be assured.

4. The advantage of preservation of useful hearing following this procedure has been established. This hearing does regress but gives many patients an advantage which is denied them by destruction of the labyrinth. Intracranial section of the vestibular nerve is the operation of choice for those patients with deafness in the unaffected ear and for those with good preoperative hearing in the diseased side. If the preoperative hearing is below that considered useful to the patient, either operation is of equal value.

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Thanks are due to Dr. K. G. McKenzie and Dr. E. H. Botterell for permission to include some private as well as public patients from the neurological service in this survey.

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Room 82, Banting Institute, 100 College Street.

### AN OSLER ITEM.

HARRIS P. MOSHER, M.D.,  
Marblehead, Mass.

My first meeting with Osler was during the First World War. Before the United States became involved, a hospital unit was formed under the auspices of the Harvard Medical School. It went to France under the name of "The First Harvard Unit." It enlisted under the British and wore modified English uniforms. The service was for four months, and then another unit from Harvard took over. It was stationed at Dannes-Camiers, General Hospital 22, as a neighbor of the Canadian hospital already there from the start of the war. On the way to France the Harvard Unit was invited to Oxford by the Oslers. I then had a chance to shake hands with Osler, but that was all, because Dr. Osler and Mrs. <sup>Mosher</sup> Osler, who went as far as London with the unit and did war work there during the stay of the unit in France, soon found out that they both were interested in book collecting and promptly paired off; and we saw but little of them until the party was over, and it was time to thank our hosts and say "goodbye."

My second and last meeting with Osler was at a dinner given by Gen. Birkett, the commanding officer of the Canadian hospital, under whose wing, so to speak, the Harvard Unit served and was coached in Army Medical Regulations. I cannot recall what Dr. Osler talked about, but I well remember that the dinner was pleasantly wet. When it was over, and I was on my way back to my tent, I tripped on the guy rope of a tent and woke next morning to find that I had a broken rib, a finding which I kept religiously to myself for the next four or five weeks. When I finally did mention the incident, there was such a general raising of eyebrows that I relapsed into silence again.

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Recently I began sending my medical books to the Otolaryngological Library at the Infirmary. I am realizing, as the saying goes, "that you cannot take them with you."

A few days ago I brought down to my small working library in my bedroom where I now do my writing, my copy of Osler's "Practice of Medicine," written as the title page says, "For Practitioners and Students of Medicine." It was one, if not the first, of the medical books that I owned. The edition is dated 1893, which was my first year in the Harvard Medical School, now 60 years ago, lacking one year. I found reading Osler at that time was like reading a story book. I still remember vividly the glow I got from it. No other medical book over the many years has repeated this. Naturally I am tender about this volume.

On the first fly leaf I found a small, hand-drawn book plate measuring an inch and one-half by two inches. This pleased me because it did not have the amateurish look of many of my early attempts at art. As was the fashion of the day, the book is bound in leather. Both covers are yellow-brown with age; both have a shaky hold where they join the back of the book; and the edges of the covers are badly frayed. For many years now, medical books have been bound in cloth; and soon will probably be bound in plastic. Books so bound have neither the appealing color of calf skin nor its intriguing softness to the touch. Only a woman's skin can equal it. I just said that I was tender about this first medical book of mine, and it is obvious that I am also sentimental about it.

This slight article is the first thoroughly reminiscent one of the many and almost yearly medical articles I have written. I hold that everyone has a constitutional right, although this is not specifically so stated in The Bill of Rights, to write one nostalgic article, and this I am now doing.

With Osler's book, where I now can easily reach it, I glanced through it a little in order to see my present reaction. Only a faint memory of the glow of the first reading came back. Medicine was a new world to me then; it is an old world now.



Hurriedly I looked through a few chapters at random to compare their style with that of the present day medical books which surround and almost smother me. The first thing which struck me was Osler's simple, straightforward, but adequate English. Wherever I looked, kindliness seemed to flavor the book.

It happened that I opened to the chapter on diphtheria. The chapter dated itself and the book by not mentioning in the treatment of diphtheria the use of antitoxin. This was natural as antitoxin did not then exist. Next I glanced through the chapter on appendicitis and then a short chapter on sunstroke at the end of the book. In the chapter on appendicitis I was curious to see what credit was given to Fitz, who was one of my instructors and professor in the Harvard Medical School. It was generally believed by us medical students that he was the discoverer of appendicitis. All medical students of my time rated a discoverer in medicine as a superman; therefore, to be in a class under Dr. Fitz was something like meeting a second Columbus. All of us, however, dreaded to be quizzed by him. His manner was icy and direct, and his questions had a dagger-like thrust. Each, as his name was called, came down from the raised amphitheater seats in the Bulfinch Ether Dome; and I for one stood there trembling. Dr. Fitz sat in the pit of the amphitheater by the side of the patient who was to be discussed. On his left and behind him, leaning against the wall, was the Egyptian mummy of pre-ether days; and directly behind him in a glass case was Morton's first ether sponge and a sparkling set of Luer's amputating knives with glorious ivory handles.

The third chapter I chanced upon was a short one on sunstroke. In this I felt again, and sharply, Osler's oft-recurring human touch. In speaking of the treatment of sunstroke, he wrote, "In cases in which the symptoms are those of intense asphyxia and in which death may take place in a few minutes, face bleeding should be practiced, a procedure which saved Weir Mitchell when a young man." At the time this was written, Weir Mitchell was at the height of his fame and known to all of us students.

Under Osler's name on the title page of his book, there is an astounding list of his professorships. In the English speaking world he became an international figure. He lists his name as William Osler, like Washington having no middle name or having dropped it. I cannot imagine his ever being called "Bill." Neither can I picture Washington being called anything but "George."

The official list of his professorships is as follows:

Professor of Medicine.....John Hopkins University.

Physician-in-Chief .....Johns Hopkins Hospital, Baltimore

Formerly Professor of the Institute of Medicine,  
McGill University, Montreal.

Professor of Clinical Medicine,  
University of Pennsylvania.

Professor of Medicine .....Oxford University, England.

I know of no other English physician who was ever called to so many universities. What illuminating experiences he must have had with university faculties. As far as I know he was too forgiving ever to write about them; and I might add that he could not have escaped seeing what shining and easy marks the ivory towers of the non-clinical professors of a medical faculty are. I have seen this in one medical faculty.

When Osler was at Oxford holding his last professorship, and I was well along in the practice of medicine, I happened to become an alumnus of the University of Pennsylvania by receiving a degree from there. This gave me a slight feeling of comradeship with Osler. It goes without saying that this was the nearest I ever got to him medically.

In looking over old medical books, I always find the advertisements at the end not a little fascinating. In Osler's "Practice of Medicine" I was stirred and warmed by the outstanding names of so many of the authors of the various books. Many of these men were the medical gods of my beginning days in medicine. One could find, I am sure, in their books

obvious hints of important medical discoveries to come. I was especially struck by the title of one book which was listed as follows: Tyndall (John), "Esays on the Floating Matter of the Air in Relation to Putrefaction and Infection, 12 mo. Cloth \$1.50." I was a bit disappointed that it was not a larger book and bound in leather like Osler's "Practice of Medicine," which inspired these nostalgic pages.

Recently, speaking of teachers of medicine with a close friend, we got onto the subject of the outstanding teachers of his day and mine. He said that he wondered if as many of the present-day teachers would rank with Osler and the rest of the well-known teachers of our day. We rather thought they did not. Youth often makes its heroes early, and often they are still its heroes when age fondly looks back upon them, yet rainbows fade, and haloes can. Today medicine is too broad and split by specialties for any man to grasp it as a whole, or to put it in simplified perspective, or make it fundamentally human as it is essentially. To credit Osler with the ability to do all of these things would be asking too much of any man yet born; yet, he could and did do many of them.

In closing, allow me to say that I am still very grateful to Osler for making my beginning days rich with the promise and glamour of medicine. Some of both, when time and circumstance have been unkind, have been dimmed momentarily; yet, my best wish for a medical student is that he may duplicate my happy start.

127 Front Street.

## NASAL IMPLANTS.\*†

JOEL J. PRESSMAN, M.D.,  
Los Angeles, Calif.

For use as dorsal nasal implants inert metals, moulded plastics, bone and cartilage, have for the most part displaced a host of other materials, and clinical experience with each of these four is the subject matter for this study.

### PLASTICS.

I shall first discuss the use of plastic implants which are premoulded to form and placed under the skin.

When inserted, these premoulded prostheses can result in cosmetic improvement more striking than that accomplished by any other technique. The plastic is inert and well tolerated. There is no danger of absorption or warping, and it requires no modeling skill on the part of the surgeon, or preparation at the operating table.

The method, therefore, offers a most tempting fool's paradise for the unwary. It was widely used immediately after the recent World War, but the disadvantages soon became apparent. Tissue can never grow into the plastic insert to fix it, so that it sits as an unattached foreign body, freely movable from side to side. To overcome this disadvantage holes and channels have been drilled through the plastic in the hope that fibrous strands growing through them will tend to fix the implant; but fibrous strands do not grow through them, and this technical modification, therefore, does not result in the implant's becoming satisfactorily fixed at all.

The circulation of the overlying skin sometimes becomes impaired, and because of this, upon exposure to low tempera-

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†From the Department of Surgery, School of Medicine, University of California at Los Angeles.

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tures the nose may become cold or painful. Due to nature's laudable attempts to develop a collateral circulation, the skin is apt to be discolored, leaving it red or purplish with vascular injection and prominent venules, all of which are very unsightly.

When the plastic prosthesis is removed, a long time elapses before the condition of the skin becomes normal if it ever does. For these reasons the use of plastic prostheses has but little place in rhinoplastic surgery, or at least not for the correction of saddle nose or to replace the bony dorsum.

#### METALS.

Metals such as Tantalum and Vitallium have been widely used in the nose in many forms, a technique for which has recently been described by Fox.<sup>1</sup>

The septum is able to tolerate large sections of tantalum perfectly well, providing it is not inserted too far anteriorly into or near the columella where movements of the nose will cause erosions of the skin with subsequent infection. The mucosa, however, will not grow over sheet tantalum, and, therefore, a mucosal covered closure of the septal defect is not to be expected. The use of tantalum in this manner is, therefore, of limited value and after some experience with it one tends to be dissatisfied and to discard its use.

Tantalum as a dorsal implant for the treatment of saddle nose is usable in many forms, including sheet tantalum bent to contour. I first used it because of the peculiar needs of a football player whose season was about to begin.

This patient had a badly macerated and deviated septum completely occluding both nares, adequate correction requiring a dorsal implant. Autogenous cancellous iliac bone was suggested but refused by the patient because of the incapacity that might result at the donor site during the early days of the approaching football season. It was, therefore, decided to substitute for the bone graft a simple plate of heavy sheet tantalum, bending it into an arch or gable simulating that of the nasal bones to serve as a temporary support.

Figure I shows the A-P and lateral X-ray views of this simple tantalum arch, its edges blunted by a dental technician accustomed to working with metals. This served its purpose admirably, giving a good cosmetic and functional result (see Fig. II-A). The patient played the entire season of football with a Pacific Coast Conference freshman football team, and suffered no ill effects. The blood supply to the skin remained good, and it suffered none of the vascular problems described under the plastic protheses. Whether it might have, had the tantalum been left in longer, I do not know.

After a few months as underlying scar tissue began to contract, an unsightly ridge, as demonstrated in Figure II-B, appeared across the dorsum at the level of the lower end of the implant between it and the lower lateral cartilages.

It was, therefore, planned to remove the tantalum and substitute a cancellous bone graft from the iliac crest; however, after removal of the tantalum the contour of the nose on the operating table was still very good, a build-up of firm fibrous tissue under the metal arch evidently having produced a rigid supporting structure. It was, therefore, decided to wait before doing the hip graft in order to observe the result without it. After a few months with nothing more having been done, the unsightly ridge disappeared, the cosmetic result was still adequate and no further scar tissue contraction, to affect contour adversely, had taken place (see Fig. III-A). The hip graft after two years has not been considered necessary. The temporary use of the tantalum arch, therefore eliminated the need for an implant, the growth of fibrous tissue under it having sufficed (see Fig. III-B).

The excellent manner in which sheet tantalum was tolerated under these unusual conditions of trauma stimulated our further interest in the use of this metal, and I can report upon a more or less extensive experience with it in various forms over a three year period. Tantalum mesh has emerged as the material of choice and when folded over and over gives a most satisfactory implant which can be cut to shape and bent to contour (see Fig. IV).

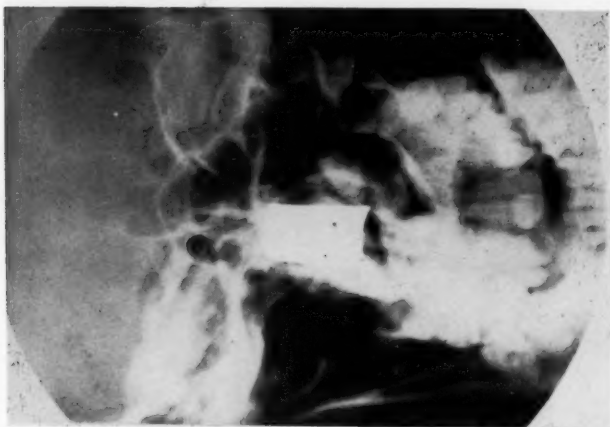


Fig. 1. Left side.

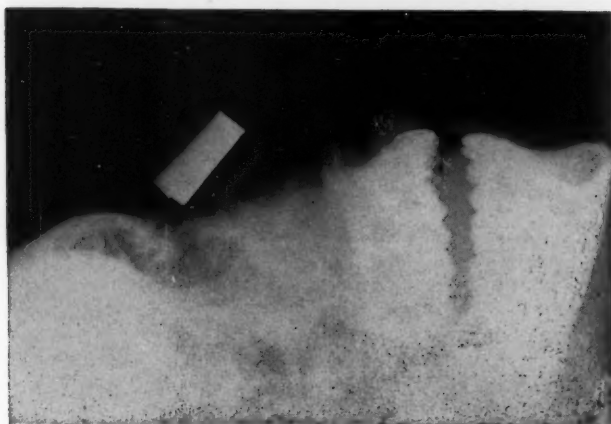


Fig. 1. Right side.



Fig. II-A.



Fig. II-B.





FIG. III-A.



FIG. III-B.

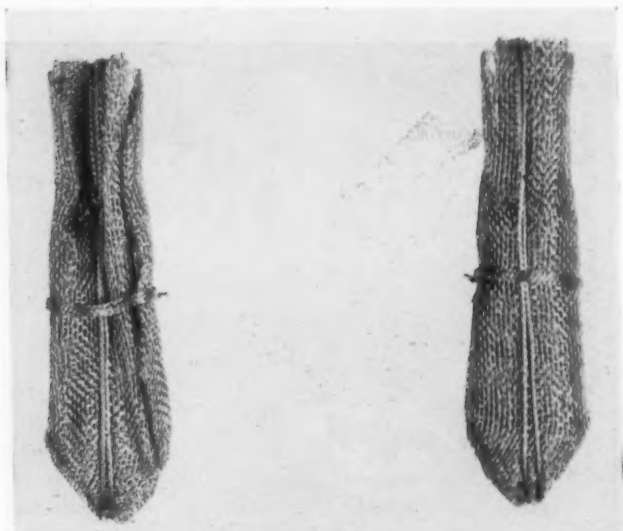


Fig. IV.

Figure V demonstrates such a prothesis *in situ*. Note that in addition to the dorsal implant there are two mesh rolls, one used as a columellar strut and the other as a tip strut. The cosmetic result can be very good as Figure VI and Figure VII show.

The implant was well tolerated, and I quote the follow-up note on this patient's chart approximately a year after the operation, since it summarizes several points of importance. The note is as follows:

"The plastic effect is pleasing. There is no evidence of any complication pertaining to either the dorsal or columellar implants. The interior of the nose is completely healed. The dorsal graft is well fixed *in situ* without unusual mobility and certainly not more than one would expect from a bone graft. The patient's skin is in excellent condition. He has been constantly exposed to the sun



FIG. V-A.



FIG. V-B.



FIG. VI-A.



FIG. VI-B.



FIG. VII-A.



FIG. VII-B.

as a parking lot attendant which exposure is well tolerated. There are no untoward effects from exposure to cold. The nasal tip is mobile and soft."

A month or two after this note was written and without forewarning, almost 14 months postoperatively, the small columellar strut sloughed out while the patient was away from home, but no appreciable change in contour resulted. Two years postoperatively a small granuloma developed at the junction of the lower and upper lateral cartilages on the left side with some drainage. The complication was considered to be due not to the nature of the implant but to its length which was greater than it should have been, resulting in a small point of erosion at the junction of the upper and lower lateral cartilages on the left side. An incision was made between the upper and lower lateral cartilages, carried across the midline, and the skin elevated off the implant for a short distance. The tip of the insert was found to be lying in the granulations, having eroded through at this point. Approximately a centimeter of the lower end of the tantalum was removed. Complete healing took place and if anything the cosmetic result was improved.

It should be interpolated at this point that while metallic dorsal implants have in most cases been well tolerated, this is not true of struts placed in the columella as battens for stiffening. Apparently due to the constant movement of the columella eventual erosion takes place with loss of the metallic strut; however, if this has been delayed for a sufficiently long period of time dense fibrous tissue will have been laid down which in itself acts as a satisfactory stiffener, so that the loss of the implant is of no consequence.

As far as the large dorsal implant itself is concerned, fibrous tissue rapidly grows into the meshes firmly fixing the graft, which blends into the structure of the nose almost as if it had been intended by nature to grow there. The surface soon becomes covered with a layer of fibroblastic tissue which grows deeply into the substances of the mesh. Such inserts become more intimately blended with the surrounding tissue,

and more firmly fixed than any other substance not excluding cancellous bone and can be removed only by sharp dissection and then with difficulty.

Early in the course of our experience with metals, and based upon theoretical grounds rather than actual experience, it seemed as though the use of a mesh might result in undesirable fixation of the skin to the underlying graft, so that a section of very thin curved tantalum sheet metal or foil was wrapped over the top surface of the mesh separating it from the skin. This was intended to permit the skin to slide more freely over the graft as it normally does over the smooth nasal bones, and this proved to be the case; however, when it was not used, experience proved there is no interference with the mobility of the skin over the mesh itself so that the use of this sheet of foil over the mesh roll was discarded, and I mention it only for the sake of completing the details.

Tantalum mesh, therefore, rolled, moulded, and cut to contour is a most satisfactory implant and deserves further investigation. I have had a few unsatisfactory results, almost invariably consisting of erosion of the nasal lining at the junction of the lower and upper lateral cartilages with subsequent local secondary infection which is characterized by a slight foul discharge and the formation of a slight amount of granulation tissue but there are usually no other signs or symptoms. On one or two occasions, a few weeks after surgery, there had been some low grade infection with local redness and edema, which was allowed to subside under treatment by antibiotics and hot packs. The implant was then removed after which complete healing always took place. A period of time was then allowed to elapse, and the incident was not considered a contraindication to the placing of another implant.

The cause of such unsatisfactory results was in each case carefully studied and evaluated with invariably the same findings which I have previously mentioned and now repeat for the sake of emphasis. Failure invariably results when the implant is too long. This produces erosion of the mucocutane-

ous lining, most often at the junction of the lower and upper lateral cartilages with subsequent infection.

The criterion for proper length is that there shall be no interference with free movement of the entire tip of the nose. A too long graft tends to fix the tip whereas one of proper length allows it to be moved freely in all directions.

The temptation to use an unduly long graft, however, is very great, since on the operating table immediate cosmetic effects resulting from the use of long grafts which support the tip as well as the dorsum can be very pleasing. This temptation, however, must be avoided at all costs since failure to avoid it will result in loss of the graft.

If, after apparent healing, erosion of the lining mucosa occurs and secondary infection, no matter how low grade supervenes, there is no point in attempting to save the graft, for even if by energetic therapeutic measures the infection is overcome, this will be only a temporary respite and should be used as an opportunity to remove the graft. Permanent cure of the secondary infection, no matter how mild, results only from removal of the cause which is the implant itself. It can at a later date, and as a subsequent procedure, be replaced. There is one exception; if the implant is too long, and the infection not acute, an attempt may be made to shorten the implant without removing it.

One very recent case, hospitalized within the last day or two, has suffered a severe local and systemic infection following the insertion of a tantalum mesh graft. Redness, swelling, localized sloughing of a portion of the skin of the lateral aspect of the dorsum occurred. It is too early to surmise the final result. It is of some importance that one year previously this same patient suffered a similar but less violent local infection following the introduction of a boiled cartilage graft which subsequently was completely absorbed.

#### BONE.

In 1945 Samuel Foman, Romeo Luongo, Alfred Schattner and Frank Turchik<sup>2</sup> concluded that insofar as transplants for



the correction of saddle nose are concerned, "cancellous bone obtained from ilium is the material of choice," by virtue of the fact that it most nearly fulfills the requirements they laid down for an ideal nasal transplant. These requirements are essentially as follows:

1. The material must be readily available in sufficient quantity.
2. Permit of easy modeling.
3. Be well tolerated by the tissues and resist infection and absorption.
4. Be not subject to change in shape after implantation.

These criteria leave little to be desired, but it is difficult to entirely agree that cancellous bone from the ilium actually satisfies them. For instance, whether the removal of cancellous bone from the depths of the ala of the ilium constitutes "ready availability" is open to argument, and the criterion of "sufficient quantity" would surely be more adequately fulfilled if something were left in case of spoilage of the graft, or a greater excess of bone were present for purposes of modeling. In some instances the amount of cancellous bone available from between cortical layers is barely enough.

Concerning the third criterion of those enumerated, there can be no doubt that cancellous bone is well tolerated by the tissues and resists infection, but it is not by any means resistant to absorption.

Clinically in almost all cases some absorption of the bone implant takes place, and in an appreciable number of instances the degree of absorption is sufficient to spoil the clinical result. In one such case a year after the graft was inserted the pleasant cosmetic effect originally achieved, as shown in Figure VIII-B, was entirely ruined by the absorption of the cancellous bone graft. Figure VIII-C shows the deterioration in appearance as a result of absorption of bone.

This is probably an extreme case, but shrinkage to some degree occurs in almost all cancellous bone grafts. In most



FIG. VIII-A.



FIG. VIII-B.



FIG. VIII-C.

of them, however, the amount of absorption is what might be called "subclinical" not affecting the result to the point of its becoming cosmetically unacceptable.

The fourth criterion (that the graft be not subject to change in shape after implantation) cannot, of course, be fulfilled by those cancellous bone grafts which have undergone marked absorption. In these latter instances a decided change in shape, as I have pointed out, obviously occurs, but otherwise the cancellous bone graft fulfills this requirement very nicely. It ordinarily becomes firmly adherent to the surrounding tissue and does not warp or become distorted in shape in any way.

Since this presentation is intended to be entirely clinical, I am purposely avoiding reference to the histological changes taking place in the bone grafts and do not want to enter into a discussion of the fate of the living cancellous bone cells or their survival or replacement by other cells, but, in general, the fate of any autogenous bone graft and the ultimate histological structure it assumes varies, for one thing, with the type of tissue with which the graft is placed in contact. Thus an autogenous living bone graft from the femur placed in contact with femur will remain as bone because of the osteoblastic activity of the osteoblastic host site, and the latter's ability to regenerate bone, but this is not true of bone placed in contact with nasal bones. The nasal bones<sup>3</sup> in common with the bony structures of the nasal septum do not have the power of bone regeneration; therefore, a bone graft placed in contact with them, as is the case in the problem I am discussing, does not have the advantage of osteoblastic activity from the host site. This very appreciably lessens the chance of survival of a bone graft transplanted into the nose and its disintegration, and replacement by fibrous tissue is, therefore, almost inevitable. Peer and Walker<sup>4</sup> found that all such grafts were replaced by fibrous tissue in eight months. Sometimes, however, the fibrous tissue which replaces the graft is adequate to maintain a satisfactory cosmetic and functional contour, but this is largely a matter of chance. From observations on bone grafts it is necessary to conclude that while often cos-

metically effective, they are not by any means foolproof and contrary to the current opinion of many authorities, my own personal experience indicates that the use of cancellous bone is not the method of choice.

#### CARTILAGE.

An adequate discussion of the use of cartilage requires that three classifications be considered.

The first of these is the transplantation of living cartilage in the form of an autogenous graft such as a segment of rib. Cartilage, if its cells are alive when transplanted, survives as living cartilage regardless of whether it is transplanted into a bed of like or unlike tissue. If cartilage is not alive when transplanted it nevertheless persists for many years in its transplanted form, but without living cells. Peer and Walker point out its gelatinous matrix is the most durable of all intercellular substances.

Autogenous living cartilage, therefore, because it is readily sculptured to contour, always available, easily removed from the host area, present in abundant quantities and able to survive as living cartilage regardless of whether it is placed in contact with like or unlike tissue, would seem at first glance to provide an entirely suitable substance for dorsal grafts; but living cartilage when transplanted presents a most serious disadvantage with which I am sure you are all familiar. It curves upon itself, or as we say, "It curls."

The tendency to curve or curl after implantation is true not only of live cartilage but also of preserved cartilage. Why this curling occurs after implantation and not before is beyond my understanding but such is the case. Cartilage would be almost ideal if the curling could be made to take place prior to its use, which statement brings me to the crux of the whole case for the use of cartilage. New and Erich<sup>5</sup> for a long time have advocated the use of cartilaginous grafts boiled prior to implantation. The boiling curls the cartilage as much as it can or will curl, and if a large enough piece of cartilage is used, then from the curled specimen a graft can

be sculptured which is practically immune to further curling. The cartilaginous cells, of course, will be dead and the graft ultimately, by an extremely slow process, will be replaced by fibrous tissue which strangely enough has a peculiar tendency to calcify. Fibrous tissue over a period of years replaces the cartilage very gradually, without appreciable or significant loss of contour. The graft soon becomes firmly fixed *in situ*, the skin moves freely over the surface, and all in all in the vast majority of cases an entirely suitable graft results.

Boiled cartilage, therefore, more closely than cancellous bone would seem to fulfill Fomon's requirements for a satisfactory dorsal graft or implant. After four years of observation covering perhaps 100 grafts which, although not an extensive experience, nevertheless qualifies one to have a definite opinion, I have a preference for the use of boiled homogeneous cartilage over the use of living autogenous cancellous iliac bone.

The question arises as to whether or not, like bone, absorption of these cartilaginous grafts may take place to a sufficient extent to spoil the plastic result. In some cases it most certainly does, and the cartilaginous graft may be completely absorbed; but this does not happen very often, and in my experience, considerably less frequently than in the instance of cancellous bone grafts from the hip.

Since compromise and risk of some sort is inevitable in such cases as these, there being no entirely satisfactory material available, a reasonable percentage of losses of cartilaginous implants by absorption is not to be considered an unduly serious disadvantage particularly since a new graft can be inserted without too great a sacrifice on the patient's part. This is not true of cancellous bone.

As experience with tantalum mesh cut to proper length grows more extensive, my enthusiasm for its use constantly increases despite the fact that it constitutes the introduction of a foreign body; but it must be tapered at the tip so as not to impinge upon the junction of the upper and lower lateral cartilages, and it must be short enough to permit full mobility

of the tip of the nose. It has one important additional advantage in that the tantalum mesh can be folded in such a manner that the proximal end of the prosthesis is thin, thus adapting itself perfectly to the contour of the root of the nose without unsightly bulging or undue prominence.

It is not possible to omit mention of the use of polyethylene sheeting cut to contour for use as either columellar battens or for dorsal tip struts or battens. This now, in all my cases, replaces septal cartilage or rib cartilage which in small thin segments is technically difficult to use without breaking. I have no statistics on the actual number of extrusions of this material as compared to cartilage, but it is certainly not greater. In 50 or 60 cases only three have been lost. The plastic is inert and causes no untoward local reaction, has a desirable degree of elasticity that cartilage lacks and is very easy to use with proper guide sutures. I find it superior to cartilage in every way.

This material, with puncture holes, also serves admirably to replace the nasal septum which is a subject to be covered in a subsequent communication.

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## CAUSES AND MECHANISMS IN RHINITIS.\*†

STEWART G. WOLF, JR., M.D. (by invitation),  
Oklahoma City, Okla.

As mere internists, my colleagues and I would never have had the temerity to investigate the nose and rhinitis without the help and advice from those in your midst, chiefly Dr. Gervais W. McAuliffe, at Cornell, and Dr. Edmund P. Fowler, Jr., at Columbia. We became interested in nasal membranes because for several years we had been looking at the stomach of an individual with a large gastric fistula. In this stomach there occurred very marked changes in turgidity and color of the gastric mucous membrane which came and went with changes in the individual's day to day situation in reaction to a great many stimuli.

During the past few years there has been a rapidly growing concept in medicine that pathophysiologic processes and what we customarily classify as syndromes or diseases are not necessarily attributable to one etiologic agent. It is becoming increasingly clear that the same biologic pattern may be called forth in response to a variety of noxious experiences. Recently there has been evidence that even symbolic noxae, that is, words or events which threaten the security of the individual by reason of earlier conditioning experiences, may initiate pathophysiologic reactions and lead to structural organic disease.

Our study involved the direct examination of the noses of a large number of people under a wide variety of circumstances. Examinations were carried out under standard conditions of lighting. A warmed nasal speculum was used for

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†Based on experimental studies done in collaboration with T. H. Holmes, H. Goodell and H. G. Wolff, and adapted from the book, "The Nose," Chas. Thomas, New York.

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inspection of the structures but no further instrumentation. The range of nasal functions, including degree of redness of the membranes, swelling, secretion, and obstruction, were roughly quantitated.

It was found that individuals vary greatly in their nasal reactivity. Some displayed wide variations from time to time in color, swelling, and secretion, while others varied but little.

The experimental subjects were exposed to a series of environmental threats. The first of these consisted of noxious stimulation of the nose with fumes of ammonium carbonate. We observed the reaction which you might expect; namely, after inhalation a sudden hyperemia, swelling of the nasal structures with hypersecretion, and obstruction. Associated with these nasal changes there occurred weeping, tearing, and spasm of the eyelids as well as strenuous coughing.

In Fig. 1 is observed the reaction time in minutes on the abscissa and quantity of secretion, color, swelling, and obstruction on the ordinate. After inhalation of ammonia, there occurred a sudden acceleration of all functions. This

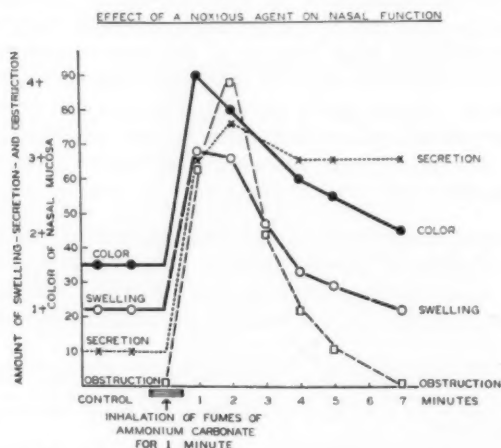


Fig. 1. Hyperemia with swelling, hypersecretion and obstruction of the nose following inhalation of noxious chemical agent—ammonium carbonate.



was obviously a reaction of defense on the part of the organism, an effort at shutting-out and washing-away and ejection of the offending substance.

Another type of assault against the person comes from the inhalation of pollens to which he may be sensitive. Accordingly, we studied a subject in an attack of hay fever from its very inception. Prior to the attack the septum and turbinates were of normal appearance. Immediately upon beginning to cut flowers in his garden, however, the subject began to cry and sneeze. The changes observed in his nasal membranes were precisely those described following the inhalation of irritating ammonia fumes. Immediately upon inhaling the offending pollens, there occurred an extreme hyperemia with hypersecretion, swelling, and obstruction in the nose. This particular attack was an abortive one, but frequently, when the swelling of the membranes was sustained, the hyperemia subsided, leaving the membranes pale but still swollen, wet, and edematous-looking. This pale, swollen state is the usual appearance of the nose of the hay fever sufferer when he comes to the doctor's office for treatment. It is clear, however, that, as in the case of inhalation of irritating fumes, the hyperemia comes first. This is another instance of the bodily reaction of shutting-out and washing-away.

Our next step was to inflict upon the experimental subject a nonspecific threat, not directed at his respiratory passages. Accordingly, an intense headache was induced by constricting the head in a tight-fitting steel crown. This was a highly unpleasant experience associated with feelings of apprehension on the part of the victim, and it provoked the same reaction of defense as that described already for more specific threats, namely, hyperemia, engorgement, hypersecretion and obstruction in the nose.

The next step was to learn whether or not situational threats which did not involve the application of physical trauma would induce such a pattern of defense with nasal changes. A threat was utilized, therefore, which depended for its force upon the communication and understanding of

symbols which, because of past conditioning experience, had acquired a special meaning for the individual.

A 40-year-old itinerant salesman had noted recurrent nasal obstruction and rhinorrhea since his marriage 14 years ago. Both his parents were Russian-Jewish immigrants. His father was a humorless, domineering baker who made liberal use of corporal punishment. His mother was a tearful, unhappy individual who, from the date of her marriage, was almost continuously pregnant until she had 11 children. The patient was the oldest. He quit school in the seventh grade at the age of 14 and began working as a travelling salesman in defiance of his father's orders to continue his education. He left home and saw little of his family thereafter. Two of his younger brothers later became lawyers. The patient was always concerned only with his own pleasures and gratifications and never developed warm emotional ties to others.

Shortly after his marriage in 1932, he opened a small retail store. In the setting of failure of this enterprise, he began to note persistent nasal obstruction and discharge. He blamed the failure on his wife since she declined to work with him in the store. The nasal symptoms partly subsided after a few months and flared up again two years later when his wife insisted on buying furniture with \$800 which he had saved to start another store. Again, the following year, symptoms recurred when she underwent a costly pelvic operation which rendered her sterile. Her failure to become pregnant had been a source of great disappointment to the patient. Once in 1935 he left her for a few weeks but returned "because I missed the comforts of home. We never got along, but she was a good cook and a good housekeeper." From that time on, his nasal complaints became chronic, never severe, but moderately troublesome most of the time with frequent nose blowing and intermittent partial obstruction.

While this subject's nasal structures were under observation, he was disturbed by a discussion of his conflicts. Prior to the interview, the membranes were of normal appearance. During the discussion which concerned his wife, who had been asked to accompany him on the visit to the hospital so that she, too, might be questioned, he became tense, tremulous and was on the "verge of tears." Abruptly there was noted reddening of the nasal mucous membranes with engorgement, hypersecretion and obstruction as shown in Fig. 2. After the discussion was ended the subject was reassured and diverted and after another hour the nasal functions had returned toward normal.

The changes in nasal function which occur under stress and which were observed in this patient after initiation of the unsympathetic interview are in themselves often sufficient to produce both obstruction and pain. Added to these, however, may be the complicating factor of infection from the ever-present bacterial and virus organisms on the mucous membrane. Given an edematous mucosa with improper drainage, a pyogenic reaction may easily be set up and, once established, the infective process might perpetuate itself.

We then examined and inquired into the life stories of several patients who came to our hospital with nasal complaints, including frequent colds and sinusitis.

In a high percentage of these individuals, as reported elsewhere, it was possible to correlate the onset and recurrence of nasal troubles with episodes of situational stress and conflict; furthermore, a fairly clear-cut pattern of attitude and behavior was recognized among these subjects. Their actions in meeting threats were predominantly defensive. The shutting-out pattern in their noses reflected a general reaction of nonparticipation, rather than aggression in dealing with problems.

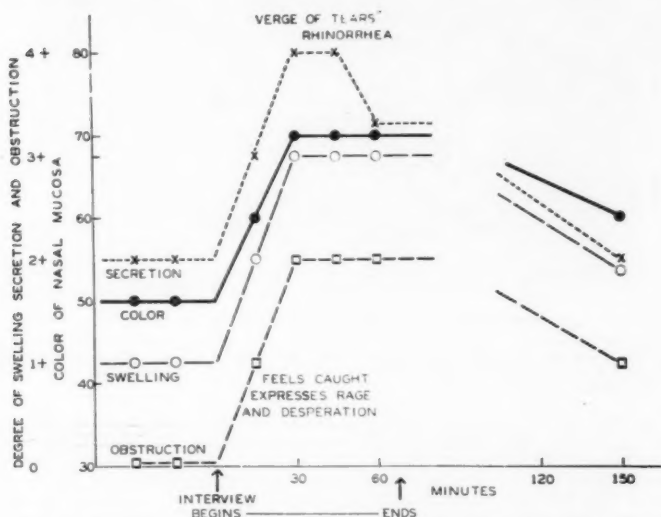


Fig. 2. Experimentally induced hyperemia, swelling, hypersecretion and obstruction in the nose during an interview in which the subject experienced anger and resentment.

While our temporal correlations of nasal disease with adverse life situations are interesting, the most convincing evidence of the relation of life situation to nasal disorders lies in the fact that it was possible with certain subjects to manipulate the situation during an interview under experimental conditions with the nasal structures in view.

Another such case (see Fig. 3) was that of a 36-year-old orthodox Jewess, whose nasal obstruction and discharge had begun four years before when she found herself caught in a serious dilemma having to do with

her failure to have vindicated her position when she broke away from her family tradition to marry a Roman Catholic. She had given up hope of her husband's measuring up and had placed all her hopes and ambitions on her children. Her nasal symptoms began when her older child was discovered to have diabetes, and two years later, when her younger child became ill, she developed asthma.

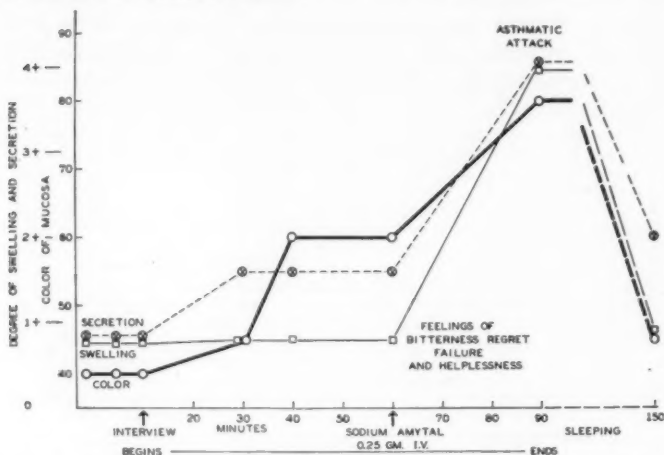


Fig. 3. Experimentally induced hyperemia, swelling, hypersecretion and obstruction in the nose associated with narrowing of the bronchial tubes during a discussion of topics provocative of feelings of remorse, guilt and resentment.

In this woman, in three interviews under sodium amytal, it was possible to turn on and off at will her nasal symptoms and asthma. During relaxation and diversion she was free of symptoms but when sensitive topics were discussed unsympathetically her nasal membranes began to swell and secrete, creating partial obstruction in the nose. Even her deeper respiratory structures constricted, resulting in a typical attack of asthma. It is clear that in response to situational threats, the same changes may occur in nasal function as in response to locally applied noxious stimuli.

#### STRUCTURAL TISSUE CHANGES AND CELLULAR REACTIONS.

##### *Biopsy of Turbinates:*

In an attempt to explore the characteristics of the tissue change and its mechanisms, a biopsy was made from the inferior turbinate of a sufferer from chronic rhinitis, first on one side during a control period of rest and relaxation, when the membranes were in an average state of activity, and again, from the opposite turbinate, at the height of a frustrating

interview when the patient was on the verge of tears. Both biopsies were made with the same technique and the same topical cocaine anesthesia. The first section showed an essentially normal mucosal structure with moderate round-cell infil-



Fig. 4A. Biopsy of nasal mucosa during control period.



Fig. 4B. Biopsy of nasal mucosa during interview at height of nasal hyperfunction associated with emotional stress. Note engorgement of glandular structures and edema of the stroma.

tration. The second revealed the mucous glands to be filled with secretion and the vascular and lymphatic channels to be prominent and dilated. The lighter stroma was indicative of edema (see Fig. 4).

*Cell Counts of the Nasal Secretions:*

Nasal secretions of the subjects were collected and stained by an appropriately standardized technique before, during, and after the discussion of significant conflicts. At the same time white blood cell counts were made on the peripheral blood. It was found that nasal hyperfunction in association with stress was accompanied by a marked eosinophilia locally and in the peripheral blood as well. The reaction is illustrated in Fig. 5. In this subject, as well as others, not only was an eosinophilic reaction observed in company with stress but also a purulent response with the outpouring by the nasal membranes of polymorphonuclear leucocytes.

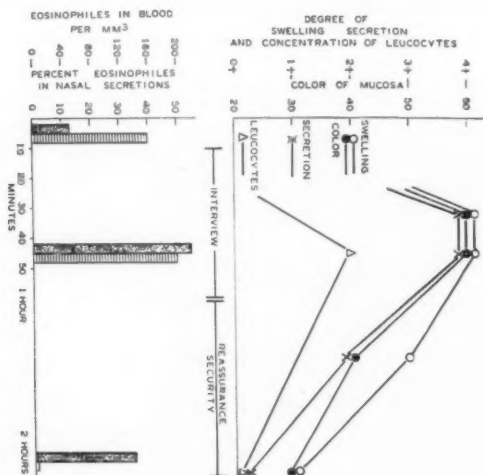


Fig. 5. Cellular reaction locally and in peripheral blood; nasal hyperfunction during anger and humiliation.

*Tissue Fragility and Pain Threshold:*

Other evidences of "organic" tissue changes in response to symbolic threats to the integrity or welfare of the organism were found to be increased fragility of the membrane and lowered pain threshold accompanying sustained nasal hyperfunction. Ordinarily, when the membranes were in their average state, minor traumata with the nasal speculum were neither significantly painful nor productive of bleeding. Under circumstances of sustained hyperemia, however, the merest contact of speculum with turbinate was intensely painful and usually resulted in erosion and bleeding.

## THE RELATIVE IMPORTANCE OF POLLEN AND LIFE SITUATION IN INDUCING NASAL HYPERFUNCTION AND EOSINOPHILIA.

Since perhaps the most pathognomonic change attributed to allergy, eosinophilia, was observed in these patients, it became especially interesting to compare adverse life situations with pollens as to their effects upon the eosinophilic reaction. Accordingly, several groups of subjects, including those with strictly seasonal ragweed hay fever, those with nonseasonal vasomotor rhinitis but without ragweed skin sensitivity, and normal subjects without rhinitis and without skin sensitivity were selected and studied by the above methods. In addition, they were exposed to between 100 and 300 gr. of mixed ragweed pollen circulating in the air of a special pollen room without their being aware of it. These experiments were carried out both in and out of ragweed hay fever season.

Fig. 6 illustrates an experiment on a 21-year-old girl who had had strictly seasonal ragweed hay fever. She was given an induced headache with the steel headband, an experience to which she submitted but vigorously resented. She couldn't have been allergically sensitized to this experience since she had never had it before, but, nevertheless, eosinophiles appeared in her nasal secretions in significant numbers.

As already noted (see Fig. 5), the same type of reaction occurred in a discussion of significant personal conflicts dur-

ing ragweed season but at a time when her nasal membranes were fairly normal and eosinophiles both in the nose and blood were at a low level.

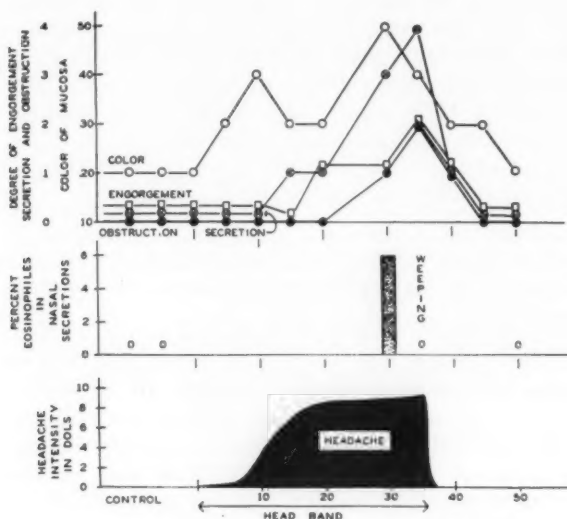


Fig. 6. Production of eosinophilia in the nasal secretions with associated nasal hyperfunction by noxious stimulation of the head.

*Comment:* Generally speaking, when nasal function was average, neither "sensitive" nor "normal" subjects reacted to mixed ragweed pollen with sufficient evidence of nasal hyperfunction to produce symptoms; however, when there was pre-existing nasal hyperfunction from whatever cause, both groups reacted to the pollen with marked hyperfunction, weeping, and sneezing. Thus, during difficult life situations productive of conflict, typical hay fever attacks followed pollen inhalation. Conversely, it was possible during pollen inhalation in the absence of frank hay fever to induce an attack by a discussion of significant personal problems and to induce subsidence of the attack by reassurance while the pollen was still being inhaled.



Fig. 7 illustrates an experiment on a 57-year-old Negro woman who also had ragweed sensitivity according to skin test, but suffered from vasomotor rhinitis both in and out of season. She was interviewed in the pollen room. It will be noted that nasal hyperfunction was induced upon entering the

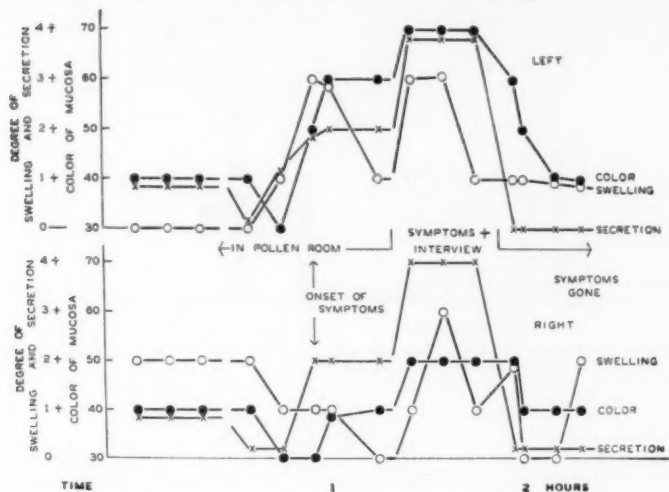


Fig. 7. The occurrence of nasal hyperfunction during inhalation of pollen accentuated by a discussion of relevant personal conflicts and dissipated during reassurance with relaxation, although pollen inhalation continued.

pollen room. It was apparently enhanced during the interview but finally subsided completely after successful reassurance and relaxation, although she remained in the room with the same quantity of pollen circulating.

The next subject, shown in Fig. 8, had no ragweed sensitivity and never had symptoms of rhinitis except for occasional head colds. At such times, however, it was possible by adding further insult, either locally to her membranes or generally to her pride, to induce eosinophilia.

*Comment:* From these data it would appear that the various factors provocative of nasal hyperfunction with symptoms of hay fever thus exert an additive effect.

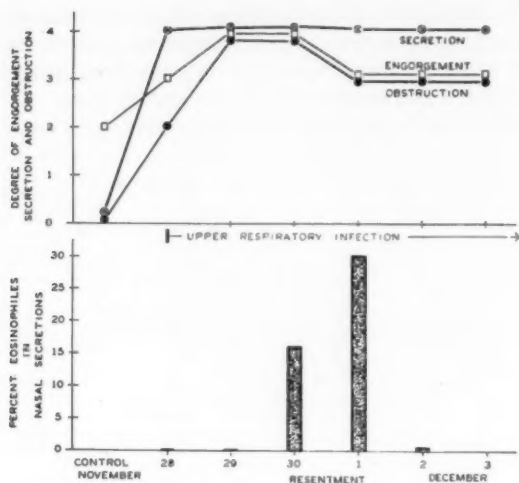


Fig. 8. The additive effect of an upper respiratory infection and emotional stress in inducing eosinophilia in the nasal secretions.

#### NEURAL MECHANISMS INVOLVED.

In an attempt to clarify the mechanism of these changes we subjected several individuals to unilateral novocaine block of the stellate ganglion. This maneuver eliminates the sympathetic impulses affecting the nasal membranes and allows the cholinergic fibres of the greater superficial petrosal nerve to act uninhibited.

It was found that when the sympathetic supply of the nose was thus interrupted by procaine injection of the stellate ganglion, the unopposed parasympathetic supply induced a state of moderate nasal hyperfunction. Such a partially denervated membrane was found to be even more reactive to noxious stimuli than usual (see Fig. 9).

#### DISCUSSION.

I would call attention to the fact that the bronchial tube is lined by the same type of mucous membrane as that which covers the nasal structures. The pathology of asthma is similar to that of rhinitis — membrane engorgement with edema,

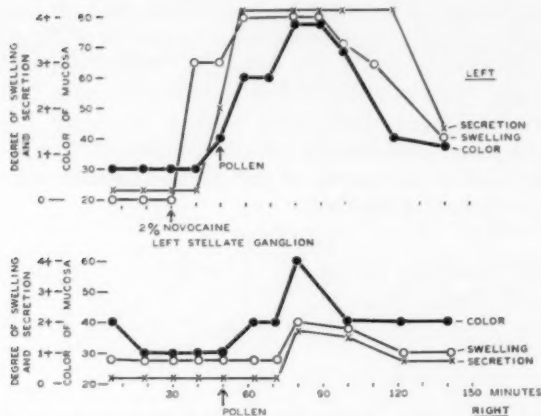


Fig. 9. Nasal hyperfunction following procaine injection of the left stellate ganglion accentuated by the inhalation of pollen with the production of symptoms of rhinitis.

hypersecretion of mucus, and obstruction. The membranes of the nose and bronchi are continuous. Many of the patients had both diseases. In those with asthma it was equally possible to "turn on" and "turn off" attitudes by manipulating the interview situation. Detailed reports of such experiments are published elsewhere.

The pattern of reaction involving the upper respiratory tree is, in essence, a defensive one of shutting out and washing away at the head end of the organism. It is appropriate and effective in dealing with an atmosphere of dust, smoke, or fumes but less so with an atmosphere of hostility from human beings; and yet, however inappropriate, it is quite obvious that it is invoked to deal with such threats and hazards. In fact, the various factors seem to work in concert and may set up a vicious cycle.

It seems likely that transitory nasal hyperfunction from whatever cause can be well tolerated by the organism, but sustained engorgement of tissues with obstruction not only led to pain and discomfort but also may have predisposed to the development of polypi and the establishment of infection locally in the nose and in the paranasal sinuses and bronchi.

It is not implied from these observations that all nasal disease stems directly from situations involving difficulties in interpersonal and social adjustments. There are certainly other major factors which set in motion the chain of events described; however, situational threats involving interpersonal and social adjustments occupy a position of importance and may modify the course of the morbid process regardless of the precipitating incident.

#### SUMMARY.

1. Life situations productive of conflict with anxiety, hostility, guilt and feelings of frustration and resentment were commonly accompanied by nasal hyperfunction with hyperemia, swelling of the nasal mucosa, hypersecretion and obstruction to breathing in the nose.

2. There was also observed an associated pyogenic-like reaction with an increase in the neutrophile and eosinophile content of nasal secretions.

3. Biopsy obtained under these circumstances revealed edema of the stroma, dilated vascular and lymphatic channels and hypersecretion of the mucous glands.

4. Cholinergic impulses to the nasal mucous membranes, probably transmitted by the greater superficial petrosal nerve, are responsible for the production of the nasal hyperfunction.

5. The pattern appears to represent an attempt on the part of the organism to protect itself by shutting out, neutralizing and washing away an environment that is literally or symbolically noxious.

6. Pain commonly accompanied the nasal hyperfunction. It radiated from under the bridge of the nose over the zygoma, in and above the eye, in the temple, upper teeth and ear. Infection of the nasal or paranasal spaces was not a necessary prerequisite for pain.

7. When such a pattern is unduly sustained, pathological changes occur which give rise to or prolong troublesome symptoms and, especially when coupled with other noxious threats and assaults, become important to the pathogenesis of chronic nasal disease.

## TRAUMATIC RUPTURE OF THE TYMPANIC MEMBRANE.\*†

LEWIS W. JORDAN, M.D.,  
Portland, Ore.

Mechanical perforation of the tympanic membrane is seen by the otolaryngologist occasionally in civilian practice but probably more frequently in military patients. In civil life, the injury is usually caused by blows upon the ear, forcible impact of water as in diving, and actual perforation by mechanical objects. In warfare, the most common cause is the explosion of high powered missiles. Except for actual mechanical perforation, the mechanism is the powerful impact of air or water upon the eardrum.

The most common symptoms are deafness, tinnitus, and sometimes a sensation of fullness in the head. Occasionally, a small amount of bleeding will be present. If there is a secondary otitis media, there will be a purulent discharge. The deafness is usually of the conductive or mixed type. Except in extreme cases, there is no relation between the size of the perforation and the degree of deafness.<sup>4</sup> The rupture of the drum membrane seems to have a protective influence upon the inner ear.

The perforation may range from a small linear tear to almost complete destruction of the drum. War injuries may involve any part of the membrane, as reported by Baron.<sup>2</sup> In most cases, there is a margin of drum between the perforation and tympanic sulcus. This is essential to healing. Shrapnell's membrane is rarely injured.

\*Read at the meeting of the Western Section, American Laryngological, Rhinological and Otolological Society, Inc., Los Angeles, Calif., Jan. 19, 1952.

†From the Department of Otolaryngology, University of Oregon Medical School, Portland, Ore.

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Infection is a common complication. Often this is present in as high as 50 per cent of war injuries, as reported by Alexander,<sup>1</sup> and in 20 per cent of civilian cases. The common cause is infected material entering the middle ear with the causative force. Another frequent cause is the indiscriminate use of ear drops and irrigations by lay and even medical attendants. Korkis<sup>7</sup> states that in his series, 26 had had drops or syringing and that 73 per cent of these developed otitis media. Of the 185 who had had no such management, 34 per cent developed infection. He also states that if a chronic nasopharyngeal infection is present, a traumatic drum rupture has a 75 per cent chance of becoming infected. Probably infection is prevented in some by the administration of antibiotics for other injuries. If the infection is carried from the external canal, it may be less virulent than if it originates in the middle ear. The type of infection may vary according to the seasonal fluctuation of bacteria.<sup>6</sup>

Certainly, an unclosed perforation is undesirable. It is a constant threat to infection from without and impairs hearing. Probably numerous swimmers have drowned because of a violent vestibular reaction resulting from cold water rushing into the middle ear through a drum perforation.

A high percentage of cases will close spontaneously. The infected ears should be treated by thorough and frequent local cleansing in addition to sulfonamides and antibiotics locally and systemically. In stubborn cases, infection in the nose, throat and sinuses should be eliminated. Many believe that the primary reaction of otitis media is a stimulus to drum repair.

After the infection has been absent for a few weeks and there is no reduction in the size of the perforation, it is advisable to apply a prosthesis. This method is highly successful, but can be used only if the ear is absolutely dry. A secretion usually floats the prosthesis off. Many materials have been advocated, including cigarette paper, cargile membrane, cellophane, sheet rubber, gold foil and celluloid preparations. It has been assumed that epithelium growing over the edge of

the perforation prevents closure. This epithelial edge is destroyed by trichloroacetic acid, silver nitrate (3 to 20 per cent), or scarification. A disc of sterile paper or other substance somewhat larger than the perforation is cut and applied tightly with an applicator. If the paper does not completely cover the opening, a second larger piece can be put over the first. The patient is cautioned not to blow the nose and the disc is left in place a few weeks. If the perforation is not closed upon its removal, the same procedure is repeated until the drum is completely healed. In applying the prosthesis, an attempt should be made to straighten out any everted or folded drum fragments. Folbre<sup>5</sup> uses cigarette paper without previous cauterization. After the paper is in place, he applies trichloroacetic acid to the outer surface of the paper by means of a small applicator. Enough of the chemical penetrates the paper to have its effect. One advantage of this method is that the treatment is finished and lack of cooperation by the patient, due to pain of the chemical, is not important.

The cauterization destroys the epithelial edge, and the artificial membrane acts as a bridge for the growth of new tissue. The foreign body reaction may be helpful in healing. The paper may prevent the formation of a crust at the edge of the perforation and in so doing it keeps the edges of the perforation moist so that it can heal without being obstructed by a dry crust. In addition, if the middle ear is completely closed, more normal physiological conditions will prevail. Application of the paper usually causes an immediate improvement in hearing and lessening of the tinnitus and also keeps out further external infection. Stinson<sup>6</sup> believes that epithelial proliferation is the important factor causing healing, while Dunlap and Schuknecht<sup>7</sup> think that the intermediate fibrous layer is more important due to its contracting and stenosing action.

Most cases close well with this procedure; however, if the perforation extends into the tympanic sulcus, closure is almost impossible. The same method can be used on central perforations resulting from primary otitis media if no infection is

present. In this type of case, a fibrotic middle ear mucosa, adhesions between the eardrum and the promontory, or a badly distorted drum are likely to cause failure.

In our civilian experience, we have been favorably impressed with the local use of the following prescription, three or four times a day, in the infected ear:

---

Penicillin .....	Unit 75,000
Dihydrostreptomycin .....	gm. 1
Terramycin .....	mg. 50
Neosynephrin HCl $\frac{1}{4}$ % q. s. ad.....	cc. 15

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The solution is warmed in a sterile teaspoon before use. Local reactions to these drugs have been very uncommon with us. After the ear has been dry at least a week, the edges of the perforation are carefully painted with trichloroacetic acid. Our prosthesis is made of ordinary prescription-pad paper sterilized in alcohol. A disc of the proper size is coated lightly with Bettman's ointment and accurately applied with a very small ring curette. The formula for this preparation is the following:

---

Oxyquinoline sulphate .....	grains 10
Trichlorobutanol (chlorethane) .....	grains 40
Scarlet Red, N. F. (Biebrich's).....	grains 96
Oleum Ricini (castor oil).....	ounces 4

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It is our practice to apply a prosthesis to all new non-infected perforations and to infected cases after the discharge has subsided and in which the healing is slow or stationary.

#### CASE REPORTS.

In the preparation of this report, I was fortunate in having access to a series of cases treated by one of my associates, Dr. Lester T. Jones, in a U. S. Naval Hospital in the United States during the last war. On May 12, 1945, a defective shell exploded in a five-inch gun turret housing on an aircraft carrier. None of the 13 men within this closed space was killed,



but all sustained bilateral rupture of the tympanic membranes. All had burns and other injuries of various degrees and all were hospitalized immediately and received adequate early treatment to the ears. Chart I summarizes the information on these cases. In a few of the patients, the information is not complete because of existing circumstances.

L.M. Jordan, M.D., Portland, Oregon

Patient	Sex	Age	Cause of Injury	Otitis Media (Days)		Wound (Days)		Perforation (Days)		Treatment	Perforation Healing Loss by Antiseptic %																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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CHART I.

In most cases, the drum closer to the explosion sustained the greater injury. All portions of the drum seemed about equally susceptible to injury except for Shrapnell's membrane. The treatment in all cases was frequent cleansing and simple local medication. Of the 26 ears, 20 (77 per cent) developed otitis media. Of this number, the infection failed to subside in only two. In 19 (73 per cent) the perforations closed completely. In one patient only (No. 13) were both perforations left permanently unhealed. Of these two ears, one remained wet and one dry. Fourteen of the perforations healed spontaneously. In six cases, paper splints were applied after the ears became dry, but were sluggish in healing. Each time

a splint was applied to the right drum of Case 1, a purulent drainage developed despite systemic sulfonamides. It was assumed that an anaerobic organism was present which could not be isolated, and for this reason, the splint was abandoned. In six cases, splints were not used because of the extreme size of the perforations. From the information in this series, it is difficult to draw a conclusion as to the effect of infection upon healing of the drum. Of the seven drums that did not close, all but one had been infected. Of the 19 healed drums, 14 had been infected.

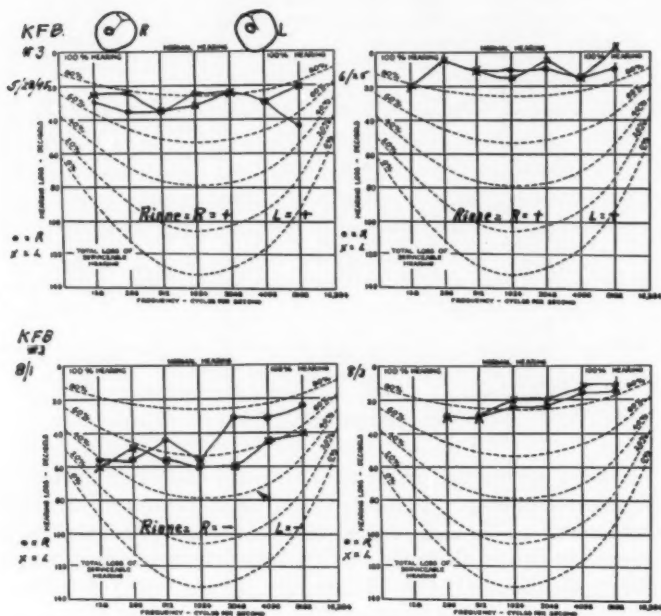


CHART II.

All patients had tinnitus of varying degree, and as far as was known, this symptom disappeared in all. The percentage (A. M. A.) of hearing loss as shown by the audiometer varied

considerably. In 10 of the 13 patients, the original test showed a greater loss in the ear closer to the explosion. In 10 of the cases the final test was also worse in the ear nearer to the blast. Since most of the cases had a relatively flat audiometer curve with positive or negative Rinne tests, it was assumed that the loss was of the mixed type with a predominance of the nerve factor. Bone conduction audiometry was not available. In 13 ears, or 50 per cent, the hearing became worse

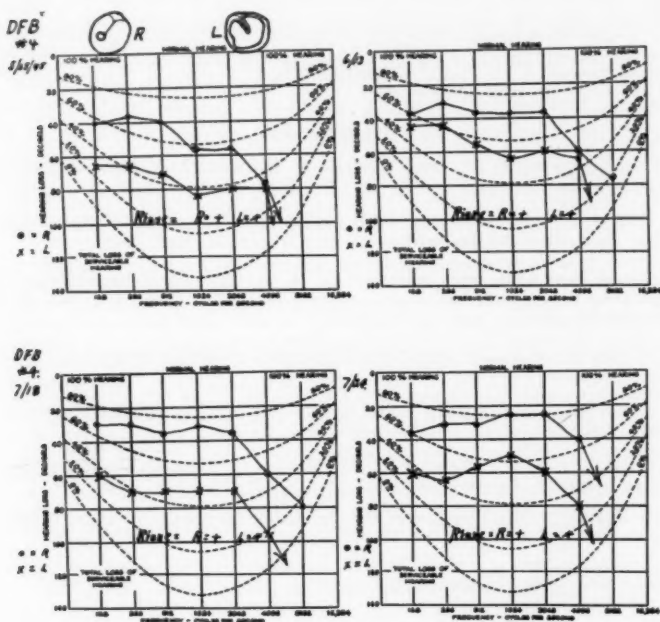


CHART III.

after a few weeks. In all but two of these cases, the hearing improved to the original or better level in the following weeks. In all but three ears the last audiometer test was better than the first. No relation between this variation and middle ear or drum behavior could be proven.

In the final examination, six men of the original 13 had permanent perforations of the drums. Originally these ruptures had all been large. Of these men, five had one drum completely healed. In only one (Case 13) were both drums unhealed permanently, one wet and one dry. The audiometer curves of Cases 3 and 4 are shown (see Charts 2 and 3).

#### SUMMARY.

Traumatic rupture of the tympanic membranes is discussed. A series of 13 patients is presented, in which all drums were ruptured by one explosion.

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## GLOMUS JUGULARIS TUMOR OF THE MIDDLE EAR

(Carotid Body Tumor, Tympanic Body Tumor,  
Nonchromaffin Paraganglioma).<sup>\*†</sup>

HARRY ROSENWASSER, M.D.,  
New York, N. Y.

In 1945, the author<sup>1</sup> described a tumor which filled the middle ear and extended into the mastoid process in the absence of any demonstrable involvement of the carotid body in the neck. At that time, I quoted a brief communication by Guild<sup>2</sup> which was of extreme timeliness and interest in that it provided a morphologic explanation for the presence of what our pathologist, Dr. Otani, felt was a carotid body type tumor. Guild's report published in 1943 is of sufficient importance to warrant its restatement:

"Human temporal bone sections reveal structures in several respects like the carotid body for which the name glomus jugularis is proposed. Usually they are in the adventitia of the dome of the jugular bulb immediately below the bony floor of the middle ear and near the ramus tympanicus of the glossopharyngeal nerve. Usually there is but a single flattened ovoid glomus about 0.5 mm. in the long diameter and about 0.25 mm. thick. Occasionally two or more smaller bodies are present. Sometimes one or all are in the canal that transmits the ramus tympanicus through the floor of the middle ear (in one case also along the course of this nerve over the cochlear promontory). Each glomus wherever located consists of blood vessels of capillary or precapillary caliber with numerous epithelioid cells between the vessels—innervation and blood supply come from the same trunks that supply the carotid body, namely, glossopharyngeal nerve and ascending pharyngeal artery through its inferior tympanic branch."

Since then there have been numerous reports in the literature describing cases, either newly recognized or composed of old cases restudied in the light of somewhat altered pathologic concepts. As stated by Winship,<sup>3</sup> certain primary tumors of the middle ear heretofore have been designated as endo-

<sup>\*</sup>Read at the meeting of the Southern Section, American Laryngological, Rhinological and Otolaryngological Society, Inc., Atlanta, Ga., Jan. 13, 1952.

<sup>†</sup>From the Otolaryngological Service, the Mount Sinai Hospital, New York.

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theliomas and hemangioendotheliomas. These diagnoses often have been made by the process of exclusion and some uncertainty has been felt regarding the accuracy of these designations.

Le Compte, Sommers and Lathrop,<sup>4</sup> in 1947, described a tumor of carotid body type arising in the middle ear. This report was followed very shortly by a communication by Kipkie,<sup>5</sup> which recounted the finding of simultaneous tumors involving the carotid body on the right side and the glomus jugularis on the left side. Winship, Klopp and Jenkins,<sup>3</sup> in 1948, described what they felt was the first instance of a malignant metastasizing glomus jugularis tumor. Their report contained the first review of the available cases and a restudy of some of the cases which had previously been diagnosed as endotheliomas and hemangioendotheliomas. This report was a timely one and represented much studious effort and application.

Lundgren,<sup>6</sup> in 1948, very thoroughly reviewed the literature, added four cases of his own and briefly discussed nine other cases previously described by other authors under varied terminology. These nine cases form the subject matter of a re-evaluation from the pathologist's standpoint and form the basis of a report by Berg.<sup>7</sup> Of extreme interest to me was the fact that three of the four cases described by Lundgren were discovered in patients with intact though bulging drums.

In September, 1951, Brown<sup>8</sup> reported an almost similar case to the above mentioned cases of Lundgren. In this instance, also, the patient had an intact bulging drum and complained of severe pulsating tinnitus in the right ear. Myringotomy resulted in severe bleeding. A radical mastoidectomy was performed. The middle ear was filled with tumor tissue. The floor of the hypotympanum was intact, with no apparent communication of the tumor with the jugular bulb.

Lattes and Waltner,<sup>9</sup> in 1949, in an excellent report, replete with beautiful histologic sections, described eight additional cases from the material of the laboratory of Surgical Pathology and Department of Otolaryngology of the College of

Physicians and Surgeons. They suggested that these tumors, which had been referred to as carotid body tumor (Rosenwasser), glomus jugularis tumor (Winship, Klopp and Jenkins), tympanic body tumor (Lundgren), be designated as nonchromaffin paragangliomas of the middle ear, and gave their reasons quite logically for this suggested designation. Bartels,<sup>10</sup> in 1949, published an excellent monograph with a complete review of the literature. Of the many things of interest he mentioned were three separate instances of carotid body tumors occurring in more than one member of the same family.

There have been isolated case reports by Fuller<sup>11</sup> (1949), De Lisa<sup>12</sup> (1950), Lewis and Grant<sup>13</sup> (1951), Winship and Louzan<sup>14</sup> (1951), Poppen and Riemenschneider<sup>15</sup> (1951) (two cases) and Dockerty, Love and Patton<sup>16</sup> (1951). In the recent report of Winship and Louzan,<sup>14</sup> they recorded an additional case. They suggested that tumor had its origin from the glomus on the inner tympanic wall in the presence of an intact hypotympanum. They summarized the literature almost up to date with a brief resumé of 42 cases; however, I am aware from personal communications of additional cases as yet unrecorded in the literature, by Arnold, Coe, Lester Brown and others, which will augment a growing literature.

I was impressed with the discussion of Dockerty, Love and Patton,<sup>16</sup> who, in an effort to cast some light on this subject and find a descriptive term which perhaps best describes this unusual middle ear tumor, stated that up to recently there were investigators who believed that the carotid body and allied structures, including the glomus jugularis, were true paraganglioma and had the same derivation as the adrenal medulla; hence, it was never really understood why the carotid body tumors did not elaborate adrenin as did similar adrenal tumors, namely, the pheochromocytomas.

Le Compte<sup>17</sup> and others have pointed out that the reaction indicating chromaffinity, which was claimed to be a cellular characteristic common to the structures mentioned, was indeed nonspecific; furthermore, the chromaffin reaction, while

strongly positive in the adrenal medulla, often is doubtfully positive or more usually negative in preparations of the carotid body. The experiences of Otani are in substantial accord with this statement. Le Compte<sup>17</sup> quotes De Castro, an investigator, who questioned the existence of a true chromaffin reaction in the carotid body, declaring that the apparent reaction was due to the presence of lipoid substances in the cells. This conclusion was largely confirmed by Hollinshead, who felt that the cytoplasmic granules were not lipoid in nature but might be mitochondria. Le Compte's opinion, in the light of present knowledge, was that the carotid body should be classified as a specialized chemoreceptor and not as a gland of internal secretion, paraganglion or arteriovenous glomus. It is obvious from the above that there still is not complete accord as to the function of the carotid body in the neck. It can be fairly stated that there is still much to be ascertained as to the classification and function of those similar smaller structures found in the dome of the jugular bulb, inner tympanic wall and in relation to the facial nerve, which so closely resembles histologically the carotid body in the neck.

Lattes<sup>18</sup> quotes Waska,<sup>19</sup> who suggested that paraganglioma be divided into chromaffin (epinephrine producing paraganglionic tissue) and nonchromaffin (nonepinephrine producing paraganglionic tissue). It is further suggested that the latter is the type usually associated with the cranial nerves.

Guild,<sup>20</sup> in discussing an excellent presentation by Weille and Lane, Jr.<sup>21</sup> (1951), stated that recently he noted glomus formations occurring along the course of the nerve of Arnold (auricular branch of the vagus nerve) as well as along the course of the nerve of Jacobson (tympanic branch of the glossopharyngeal nerve). Typical glomus formations were seen along the nerve of Arnold as far distal as to that point where it crossed the descending part of the facial nerve. It has been pointed out by Lundgren that glomus formations similar to those described by Guild have been the center of much discussion in the anatomic literature as far back as 1840, when Valentin described a slight swelling around the



tympanic nerve, which he termed *ganglion tympanicus*. In 1878, Krauss described the similarity between what he called the *glandula tympanica* and the *glandula carotica*.

The practical significance of the finding of glomus-like formations in the aforementioned additional locations readily explains the early involvement of the facial nerve in some cases and the absence of involvement in others depending upon whether or not the origin was from the inner tympanic wall anlage or from a glomus situated in the floor of the middle ear or in close relation to the jugular bulb or facial nerve.

In the discussion of Weille and Lane's paper, mention was made of additional instances of carotid body tumor by Hoo-ple<sup>22</sup> (three cases), Walsh<sup>23</sup> (four cases) and Miller<sup>24</sup> (one case). The case described by Miller was similar to one of the cases reported by Weille and Lane, Jr., in that the tumor destroyed the petrous bone and eroded through the nasopharynx. Fortunately, this is an uncommon occurrence. I am certain that many critical reviews and re-evaluations of vascular tumors of the middle ear are currently under way, and in the not too distant future many additional reports of carotid body tumor, glomus jugulare tumor, tympanic body tumor or nonchromaffin paraganglioma will be recorded.

In the clinical reports of these tumors there have been noted certain oft repeated symptoms and this has resulted in a tendency, on the part of some, to ascribe specificity of symptoms to these tumors. I am in accord with the attitude expressed by Lattes and Waltner and others, that most of the symptoms presented by patients with these tumors are non-specific, and may be observed in any instance in which the external auditory canal or middle ear is gradually obstructed by an expanding tumor.

In 1940, I<sup>25</sup> wrote a paper entitled, "Neoplasms Involving the Middle Ear," in which the symptoms and signs manifested by these neoplasms, a squamous cell carcinoma, an adenocarcinoma, a neurofibroma and a fibrosarcoma, were included in a table. Also included in the table is carotid body

tumor, a case of lipoid granulomatous and an additional squamous cell carcinoma. Carotid body tumors are richly vascular, and this explains the tendency to bleed upon gentle manipulation, to a degree perhaps greater than with other tumors, however, bleeding has been a manifest clinical symptom in many different types of tumor involving the middle ear and mastoid bone (see Fig. 1). As noted in the table,

ANALYSIS OF SYMPTOMS MANIFESTED BY DIFFERENT TYPES OF NEOPLASMS INVOLVING MIDDLE EAR AND MASTOID.

CASES	AGE	DIAGNOSIS	MASS PRESENT IN CANAL	FREE BLEEDING WITH GENTLE MANIPULATION	FACIAL PARALYSIS	SEVERE PAIN	TINNITUS	HEARING	DISCH'G
Case I	56	Squamous cell carcinoma	Yes	Yes	Yes	Yes	Yes	Very poor	Yes
Case II (D.I.)	65	Adenocarcinoma	Yes	Not Marked	Yes	Yes	Yes	Total Deafness	Yes
Case III (C.F.)	60	Fibrosarcoma	Yes	None	Yes	Yes	None	Impaired	None
Case IV (P.B.)	65	Neurofibroma	Yes	Yes	Yes	None	None	Very poor	Yes
Case V Mrs. S.	40	Squamous cell carcinoma	Yes	Yes	None	Yes	Yes	Impaired	Yes
Case VI (R.H.)	50	Lipoid Granulomatosis	Yes	Yes	Yes	Yes	Yes	Very poor	Yes
Case VII (W.L.)	36	Carotid Body Tumor	Yes	Yes	Yes	None	None	Very poor	Yes

Fig. 1.

the presence of pain, facial paralysis, impaired hearing and tinnitus are fairly constant findings, particularly in the late stages of the disease of all these tumors. Severe tinnitus has been a fairly consistent symptom it seems, before the tumor causes destruction of the drum membrane, and this is easy to understand. The tendency for so-called aural polypi or granulomata with associated chronic middle ear suppuration to present protean symptomatology is too well known to dwell upon.

It is generally accepted that the gross appearance of the tumor does not present characteristics sufficiently definite to enable one to make a diagnosis clinically. This is particularly true in those instances in which there is associated middle ear suppuration with attendant acute or subacute inflammation, with its alterative inflammatory effects upon the underlying tumor. I am intrigued with the reports of the cases of Lundgren, in which the patients were operated upon before the tumor had had the opportunity to enlarge and erode through the drum or Fallopian aqueduct. In one instance (Case 1) the patient did not have facial paralysis or pain. It is easy to understand why this expanding space-filling mass in the middle ear cavity was accompanied by roaring tinnitus and deafness. Three of the four cases presented by Lundgren had almost identical signs and symptoms. In the instances in which myringotomy was performed, the persistent bleeding which ensued from the opened middle ear was of clinical diagnostic significance.

In the instances in which a tumor mass presents in the ear canal, accompanied by aural discharge, I have not been impressed with the occurrence of tinnitus of a pulsating type, in sufficiently high percentage of the cases to feel that this symptom is of any special diagnostic significance.

It has been stated that similarity in the appearance of the bone defects have been noted in Roentgenograms of the petrous pyramid and mastoid bones in proven cases of glomus jugularis tumors. I suppose it is not illogical to expect that tumors originating on the inner tympanic wall or from the floor of the middle ear, slowly expanding, might at a proportionate period of their growth, conceivably produce comparable bone defects. As a clinician, I am somewhat loathe to attempt a specific diagnosis as to the nature of a tumor from the type of bone defect observable Roentgenologically.

#### PATHOLOGY.

From the histopathologic standpoint, there is noted in the analysis of the reports in the literature considerable repetitive uniformity in the morphologic characteristics of these

tumors. The groups of tumor cells are bordered by capillaries and tend to form alveolar structures. This alveolar arrangement of the neoplastic cells is not always distinct. In some places the cells take the form of compressed cord-like structures (see Fig. 2).

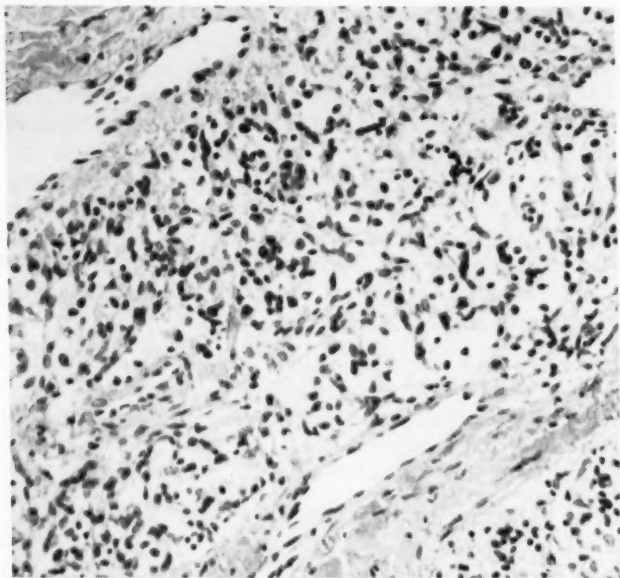


Fig. 2. A representative area of the tumor from the tympanic cavity. Note the characteristic tumor cells in groups, like nests, separated by dense fibrous tissue stroma. The empty spaces indicate the extremely vascular nature ( $\times 275$ ).

The cells usually are large and polyhedral. The nuclei are small and not hyperchromatic. The abundant cytoplasm is frequently vacuolated. This vacuolization obscures the cell outlines in many instances. There often is considerable uniformity in the oval shape of the nuclei, although there may be areas in the tumor in which the tumor cell nuclei vary in shape. Mitotic figures were not noted in our original report; nor has its occurrence been noted with any frequency in the many subsequent reports to date. I would like to point out

the identical histologic features in Fig. 3, a section made from a typical carotid body tumor in the neck when compared with the tumor section from the tympanic cavity (see Fig. 2).

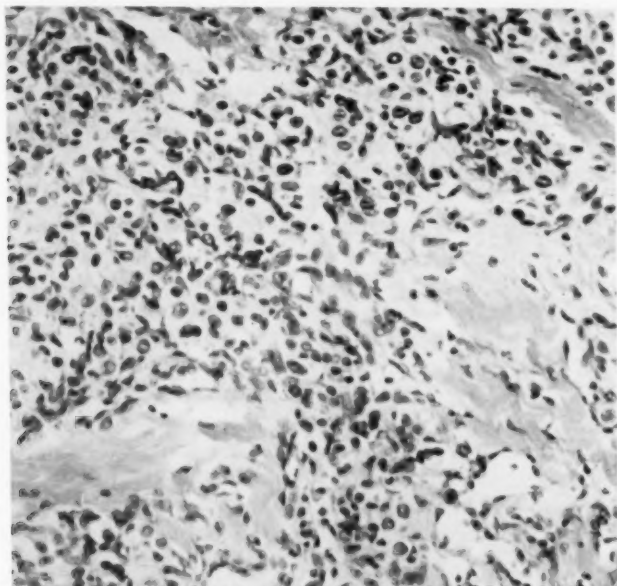


Fig. 3. A representative area of a typical carotid body tumor removed from the neck. Note the characteristic tumor cells in nests, separated by dense fibrous tissue stroma and the vascular nature of the tumor. The identical histologic features of this tumor and the tumor in Fig. 1 are notable ( $\times 275$ ).

#### TREATMENT.

The treatment of this entity is surgical. When the tumor originates from the glomus structures on the inner tympanic wall and if operated upon before widespread erosion takes place, it is quite possible to completely eradicate the tumor. Instances of this type have been described by Lundgren and others and support this contention. If the tumor arises from the glomus jugularis in the floor of the middle ear and erodes through the bony floor and intimately involves the jugular bulb, it poses a far more serious surgical problem. There

have been differences of opinions expressed as to the wisdom of ablation of the bulb in view of the inherent risk in the surgery involved. When one considers the known slow growth of the tumor and the relative rarity with which metastasis occurs, it may lend some support to this conservative attitude. If the tumor arises from glomus structures in close proximity to the facial nerve with early onset of facial paralysis it may necessitate removal of part of the facial nerve to remove the tumor. This must, of course, be combined with some type of facial repair; perhaps the short-circuiting type of facial nerve repair advocated by Lempert.

In the surgical treatment of these tumors, hemorrhage at times of considerable severity must be anticipated. Adequate measures to replace blood loss with transfusions and other supportive measures should be readily available. It is becoming increasingly apparent from the available opinions expressed that radiation even as administered today, unaccompanied by surgery, offers little of encouragement. Generally speaking, the earlier in the course of the disease one encounters this condition, the more likely is the chance for complete removal, and obviously, the better the ultimate prognosis. Because of the known slow growth of these tumors, there must be a prolonged follow-up before one may be assured of complete cure.

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## MODIFIED RADICAL ANTROTOMY.\*†

LEE SHAHINIAN, M.D.,  
San Francisco, Calif.

Surgical treatment of the maxillary sinuses is not often necessary. It should be reserved for those cases of chronic purulent maxillary sinusitis which have drainage deficit. This diagnosis is properly made in cases in which there is definite objective proof of chronic bacterial infection of the mucous membranes. It should never be made on the basis of symptoms alone, such as chronic postnasal discharge, nor should it be made by Roentgenograms alone because similar shadows may be cast by vasomotor congestion due to allergic, metabolic, psychosomatic or other causes. On the other hand, the unvarying finding of true pus in the wash returns of antrum irrigations at repeated, adequately spaced intervals, is a pathognomonic sign of true chronic bacterial infection with drainage deficit. In such instances cultures and antibiotic sensitivity tests are desirable preludes to a thorough trial of combined irrigation therapy and appropriate chemotherapy in these cases. If complete cure is not thus obtained, surgery is advisable.

A word regarding incidence. The disease is relatively uncommon in spite of the fact that the diagnosis is made with cheerful abandon by laymen and unqualified professionals alike. The author's own records disclose approximately 2,500 separate patients over a period of 12 years who specifically complained of symptoms referable directly or indirectly to the nose or sinuses. These symptoms included so-called sinus headaches, postnasal drip, nasal congestion, rhinorrhea and sneezing, facial pressure sensations, acute sinus infections,

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†From the Department of Surgery (Otorhinolaryngology), Stanford School of Medicine, San Francisco, Calif.

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*et cetera*. From this entire group of approximately 2,500 individuals the author was able to make a diagnosis of chronic purulent sinusitis with drainage deficit in no more than 35 cases. Thus, it can be seen that if the disease is present in about 1 to 2 per cent of individuals who have specific nasal complaints, the natural conclusion would be that the percentage of incidence is much lower in the populace at large.

Surgical therapy should be considered in chronic maxillary sinusitis only when there is a drainage deficit, or in other words, a constant pooling of pus. If ciliary activity is capable of clearing pus exuded from inflamed mucous membranes, there is likely to be no benefit obtained by creating auxiliary gravitational drainage facilities because these would be ignored by the ciliary stream. Likewise, extirpation of abnormally appearing mucous membranes in antrums without drainage deficit does not always offer a permanent solution because the membranes which subsequently replace them too frequently become infected because they regenerate from contiguous areas which are also usually infected in varying degrees. These cases of chronic bacterial sinusitis without drainage deficit are best treated by systemic chemotherapy and hygienic measures.

In the past there has been two schools of thought regarding maxillary sinus surgery: some rhinologists prefer intranasal surgery but are willing to use the so-called radical or sublabial approach in selected instances; others feel that the sublabial approach is the one of choice for most cases. In the earlier years of the author's practice the intranasal approach was favored whenever possible because it appeared to be the most conservative method of achieving the objective of adequate drainage. The fact that so many cases could be cured by this simple procedure made it seem likely that a more precise method of making the intranasal window should appreciably increase the percentage of cures. In this respect it must be admitted that the sublabial approach offers several obvious advantages. With it, the creation of the nasoastral window can be executed with much finer surgical precision. In addition, it allows ideal circumstances for definitive inspec-

tion of the sinus cavity. One is thereby far less likely to miss a foreign body or an early malignancy; furthermore, minor procedures such as extirpation of a polyp or removal of a biopsy specimen can be performed with far greater ease than through the nose.

Thus far, it is obvious that nothing more has been said than Caldwell and Luc reported many years ago. The entire thesis of this article rests on one important difference in technique, made possible by the antibiotic medications of our modern era. The mucosal lining of the antrum is carefully preserved in all cases even though the sublabial approach is used. Hence, the outstanding conservative feature of the intranasal approach is maintained.

After sublabial exposure of the antrum lumen, it is common practice among rhinologists to inspect the cavity and then proceed in one of two manners. If the lining looks almost normal the surgeon usually preserves it and contents himself with the creation of a good nasoantral window. On the other hand, if the lining looks at all bad, *i.e.*, edematous or eroded, the operator usually removes the entire antral mucosa before creating the nasoantral window. When the mucosal lining is thus entirely removed (see Fig 1B) the pattern of healing is by secondary intention, comparable to the process which occurs when a large area of skin and subcutaneous tissue is lost over a bone area on the body surface, leaving a large gap for the skin to bridge. As a part of the process of healing by secondary intention after radical antrotomy, granulations begin to appear after a few hours on the denuded bone surfaces. At the same time, mucosal epithelium begins to extend toward the antrum walls by proliferation from cut edges of nasal mucosa in the region of the natural ostium and the newly created inferior meatus opening. The extent of the gap (see Fig. 1B) is so great that the extension of epithelial growth cannot keep up with the development of granulation tissue (see Fig. 2A). The latter becomes quite exuberant and may nearly fill the antrum lumen; yet, surprisingly, in a large percentage of cases, the healing is completed in a much shorter time than could be expected by extension of the nasal

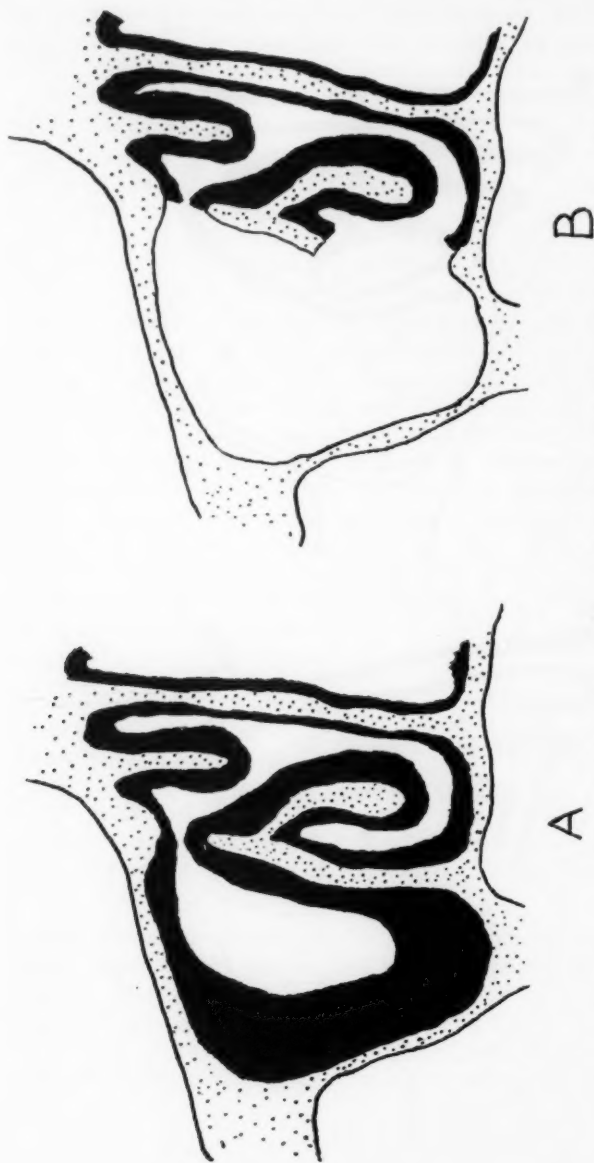


Fig. 1. (A) Diagrammatic section showing thickened mucosa of chronically infected antrum. (B) The standard procedure in classical radical antrotomy includes complete extirpation of diseased mucosa as well as creation of inferior meatus window. A gap as long as 7 cm. is left for the mucosa to bridge in order to effect healing.

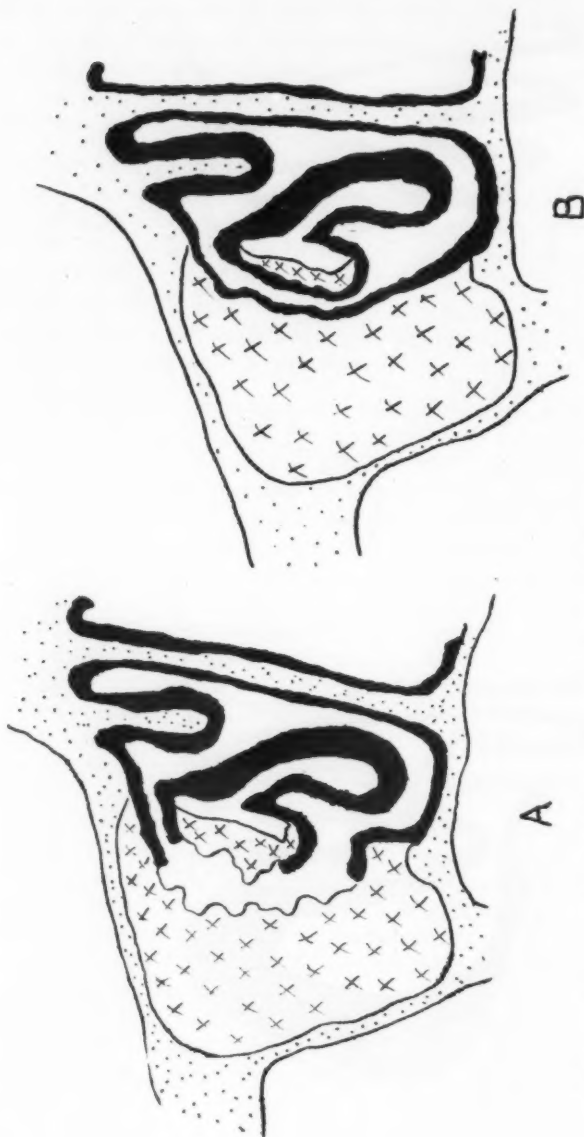


Fig. 2. (A) Process of healing after complete extirpation of antral mucosa is one of secondary intention. Granulations, depicted by crosshatched area, arise from the denuded bone surfaces. Nasal mucosal epithelium extends toward the antral walls from the nasal ostium and from the newly created inferior meatus opening. (B) Rapidity in healing time after standard radical antrotomy is due to the granulations causing a shortening of the distance needed to be traversed by extending mucosal edges in order to effect a sealing juncture.

mucosa around the entire antrum circumference. In the past this rapidity of bridging has been credited to epithelium proliferating from mucosal islands in the grossly denuded bony wall; however, observations with a nasopharyngoscope during the early postoperative period indicate that the reduction of healing time may be in large part due to the part played by the granulation process in causing a shortening of the distance needed to be traversed by the extending mucosal edges in order to effect a sealing juncture (see Fig. 2B). Thereafter, this same granulation tissue begins to change in classical manner into fibrous tissue. The shrinkage associated with this change causes marked retraction toward the bony walls of the antrum with the result that the newly sealed mucosal surface is also drawn laterally (see Fig. 3A). The mucosa thus severely stretched and thinned may play a part in the irregularity and incompleteness of the retraction process, so that subsequent examinations by antroscopy or by Roentgenograms rarely show other than a distorted sinus lumen. In some cases, granulation synechiae may cause the creation of two sinus cavities (see Fig. 3B). Many of these cases do very well after surgery in spite of this distortion, but unfortunately a disturbing percentage are prone to frequent recurrent infections.

Normal sinus mucosa is capable of a considerable range of erectile excursions as a response to various physiological stress conditions. The new retracted and thinned mucosa of the classical radical antrotomy with its fibrous bed has a greatly reduced capacity for such excursions. As a result, there are not infrequently varying degrees of annoying postoperative neuralgia-like symptoms which may be due to inability of the membranes to make a natural adjustment when such stress conditions prevail.

The conservative sublabial operation advocated by the author is based on the proven fact that the mucous membrane lining of the antrum has amazing recuperative powers. In spite of the miserable appearing condition it may present in some cases, proper treatment converts this mucous membrane into a lining which is superior in appearance and physiologi-

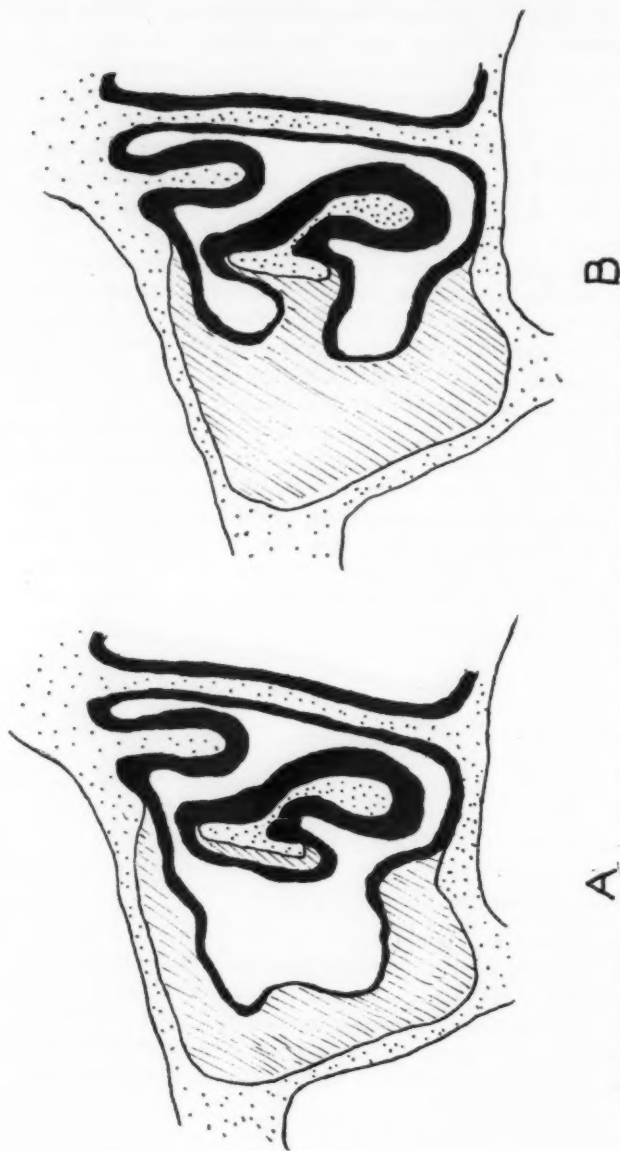


Fig. 3. (A) The shrinkage associated with the conversion of granulation tissue into fibrous tissue causes marked retraction to form the only antral walls with the result that the newly sealed mucosal surface is also drawn laterally. The mucosa thus is retracted and thinned and may play a part in causing the irregularity and incompleteness of the retraction process. Subsequent endoscopy or antrostomy usually demonstrate a distorted sinus lumen. (B) In some cases granulation synechiae may cause the creation of two sinus cavities.

cal function to that which replaces the completely extirpated lining. The procedure is as follows: After routine exposure of the antrum lumen through the canine fossa opening, the purulent secretions present are removed with suction. Advantage is taken of the excellent exposure to inspect the cavity carefully. Discrete polyps, cysts and pyoceles are carefully treated by excision or incision, with care not to injure surrounding tissues. Appropriate specimens, if any, are sent for histological study. Beyond this, with the exception of that necessary to create the nasoantral window, no membrane lining is removed. This includes eroded mucosa, markedly edematous mucosa and mucosa studded with cysts or pyoceles. The latter two are marsupialized by removing the presenting surfaces of the lesions with a ring punch (see Fig. 4). Special attention is then directed to the creation of a nasoantral

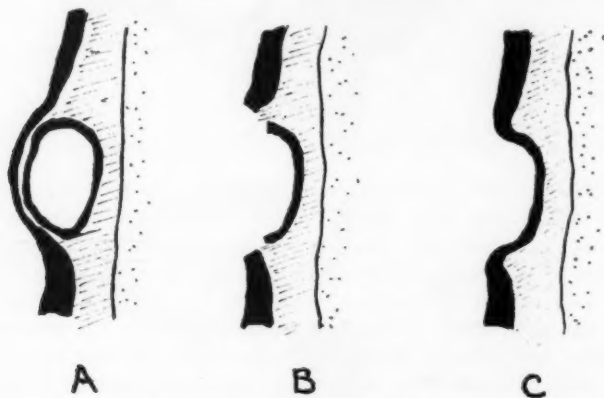


Fig. 4. The modified radical antrotomy could be termed radical only because of the sublabial approach. No membrane lining is removed with the exception of that necessary to create the nasoantral window. Cysts and pyoceles are marsupialized by removing the presenting surfaces with ring punch (A) with subsequent healing as depicted in (B) and (C).

window with size and shape of predictable permanency. This is accomplished by first removing a piece of antral mucosa about 1 cm. in diameter, followed successively by similar sized sections of opposing bone and inferior meatus mucosa (see Fig. 5). Following this, the mucosa on either side of the bone

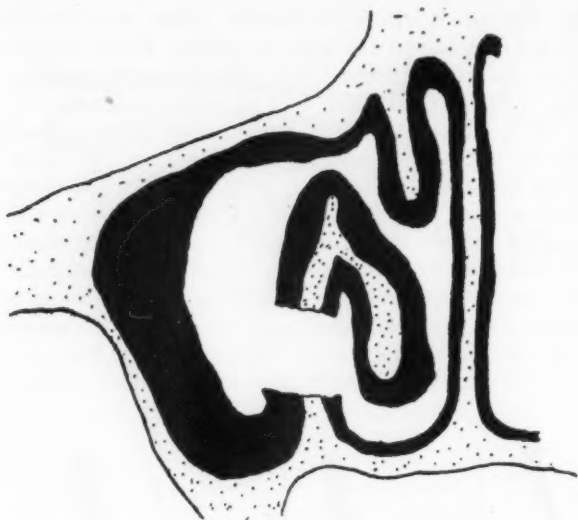


Fig. 5. First stage of creation of nasooantral window with size and shape of predictable permanency. The turbinate is in no way disturbed.

edge is elevated to a distance of about 3 mm. (see Fig. 6A), after which the thin plate of bone sandwiched between is submucously resected (see Fig. 6B and 6C). This is accomplished with relative ease on all but the anterior edge (see Fig. 7A). For this portion the following technique is used: The antral mucosa is first incised diagonally in the anterior superior and inferior corners and thereafter elevated forward (see Figs. 7B and 7C). The bone edge thus exposed is then bitten off with Hajek forceps (see Fig. 7D), bringing into view the tented edge of the inferior meatus mucosa. The antrum mucosa is then flapped back against the latter (see Fig. 7E). It is also best not to have the lower edge of the window too close to the floor of the nose. Here the bony partition becomes too thick to allow accurate performance of the submucous procedure. The purpose of this surgical refinement is as follows: The submucous resection allows the mucoperiosteal surfaces of the antral and nasal linings to make





Fig. 6. Second, third and fourth stage of creating the inferior meatus window. The mucosa on either side of the bone edge is elevated to a distance of 3 mm. after which the thin plate of bone sandwiched between is submucosally resected. This allows the mucoperiosteal surfaces of the antral and nasal flaps to make contact in an everted manner.

contact in an everted manner. This is a basic principle in good surgical practice of joining epithelial surfaces to encourage healing by first intention. A window of this type heals with little or no interference from granulations, maintains its original size, has knife-like edges when healed, and has as little chance of closing as does a postoperative septum perforation of the same size.

The turbinate is in no way disturbed. It is not advisable either to push it toward the septum or to amputate its anterior tip.

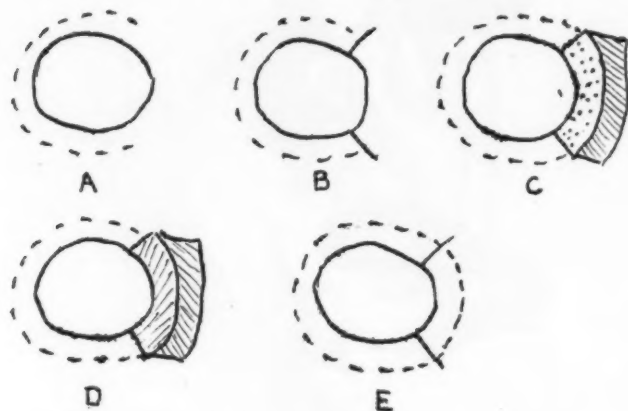


Fig. 7. Submucous resection of the inferior meatus window as shown in Fig. 6 is accomplished with relative ease on all but the anterior edge. In this portion the following technique is used: The antral mucosa is first incised diagonally in the anterior superior and inferior corners (A) and thereafter elevated forward (B, C). The bone edge thus exposed is then bitten off with Hajek forceps (D), bringing into view the tented edge of the inferior meatus mucosa. The antrum mucosa is then flapped back against the latter (E). It is best not to have the window too close to the floor of the nose. Here the bony partition becomes too thick to allow accurate performance of the submucous procedure.

The author has performed the modified radical antrotomy on 17 consecutive cases of true chronic antrum infection in this manner over a period of eight years. Many of the cases in this series had mucous membrane linings which appeared to be in very poor condition. Concomitant surgical procedures were performed when indicated. These included submucous resection, intranasal ethmoidectomy, and removal of nasal polyps, both mucus and granulation type. Empirical systemic chemotherapy was administered intensively in all cases for about five days after surgery. The average hospital stay was three days after operation. Discomfort during this period appeared considerably less than that experienced after extir-

pation of 15 to 20 sq. cm. of antral mucosa. Postoperative antrum irrigations were omitted in most cases. In others, it was done infrequently and then primarily for the purpose of evaluating the progress of healing. Frequent examinations with a nasopharyngoscope demonstrated uniformly rapid healing in the region of the inferior meatus opening by primary intention due to the proper apposition of mucosal edges. The same instrument showed the walls of the cavity to be surprisingly smooth in most cases. X-ray examination after several months demonstrated normal or varying degrees of thickened mucosa with relatively little distortion of lumen shape. Normal ciliary pathways and capacity for erectile excursion were not disturbed because the lining was not extirpated. This may account in part for the fact that no disturbing neuralgias or persisting unpleasant sensations occurred in any of the cases in this series. Further studies with a nasopharyngoscope after surgery indicate that the inferior meatus opening serves only in auxiliary capacity to drain unwieldy masses of secretions during the postoperative healing stage and during any acute flareups which might occur after healing is complete. Proof of this was obtained by postoperative experiments on several cases in which the membrane had been preserved even though apparently in extremely poor condition. India ink placed into the antrum clearly indicated that the ciliary function carried debris to the natural ostium rather than to the more dependent and much larger operative opening.

The principle here outlined is not new. The small series presented may be unique, however, in that the cases were consecutive, entirely unselected, and every phase of infection severity was encountered. One of the cases in the series is an allergic individual who still develops recurrent acute attacks of bacterial infection in the operated antrum several times a year. Response in this case is rapid to antrum irrigation combined with systemic chemotherapy. In the rest of the series, the modified radical antrotomy as described resulted in unequivocal healing with surprisingly few subsequent acute attacks. Observation of this group has reinforced

the confidence of the author in the recuperative abilities of infected sinus mucous membranes when aided by conservative drainage created in a precise manner.

#### SUMMARY.

Antrum surgery should be reserved for cases in which there is definite evidence of chronic bacterial infection with drainage deficit. Such conditions are relatively uncommon. It is advocated that surgery be performed through a sublabial incision, but no antrum mucosa be removed with the exception of that necessary to perform biopsies, treat polyps, cysts, abscesses, and to create the nasoantral window. A method is described for making a window with size and shape of predictable permanency. The results of 17 consecutive cases thus treated are discussed.

## FIRST INTERNATIONAL CONGRESS OF HEARING TECHNIQUE.

The first International Meeting on Hearing Technique will be held at Sanremo Italy, Sept. 21-28, 1952. The subjects to be discussed will be: street noises, factory noises, acoustic insulation in buildings, apparatus for hearing measurements and deafness diagnosis, apparatus for testing the simulation of deafness, artificial hearing apparatus, apparatus for teaching deaf people and backward children, initiatives and institutions to combat noises and deafness.

Official exhibition, with didactic and display purposes of technical apparatus, institutions, pedagogical means, printed matter, etc., that may be of interest to visitors. There will also be a scientific film display for specialized schools, and another as to make known our progress in the fight against noises. The most important communications will be displayed in their practical function. Every participant will be enabled to hear all lectures and communications in his own language by means of headphones of the simultaneous translation apparatus.

Hotel accommodation is excellent. In both luxurious and modest hotels one will find first class service and reduced terms.

Meetings will be held at Teatro dell'Opera of the Casino Municipale at Sanremo—delightful capital of the riviera of flowers. For further information, contact Centro Audiotecnico Internazionale, C.P. 207, Sanremo, Italy.

## VOLUNTEER.

A citizen army . . . two million strong . . . goes into action in October to insure the nation's health and welfare for the year to come.

Volunteers in a united campaign to raise money for some 17,000 Red Feather services, these men and women will solicit their fellow citizens for contributions to home town agencies and national health and welfare programs such as those made necessary by the defense effort.

This once-a-year campaign by the country's Community Chests and the United Defense Fund insures the health and welfare services so vital to the entire community.

Volunteer *your* time now to your town's United Red Feather Campaign.

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## THE UNITED WAY.

October is Red Feather month . . . the time each year when health and welfare agencies unite in one campaign to raise money for the continuance of their services.

In towns and cities all over the United States and Canada these services for babies and young people, for families, for the ill, the aged and the handicapped are vital to the welfare and happiness of every individual in the community.

Home town needs and national health and welfare programs such as those made necessary by the defense effort are met by *your* contribution to *your* united Red Feather campaign.

*Give now, the united way, for all Red Feather services.*

**HEARING AIDS ACCEPTED BY THE COUNCIL ON  
PHYSICAL MEDICINE OF THE  
AMERICAN MEDICAL ASSOCIATION.**

June, 1952.

**Audicon Models 400 and 415.**

Manufacturer: National Earphone Co., Inc., 20-22 Shipman St., New-  
ark 2, N. J.

**Audivox Model Super 67.**

Manufacturer: Audivox, Inc., 259 W. 14th St., New York 11, N. Y.

**Aurex Models L and M.**

Manufacturer: Aurex Corp., 1117 N. Franklin St., Chicago, Ill.

**Beltone Symphonette; Beltone Mono-Pac Model M.**

Manufacturer: Beltone Hearing Aid Co., 1450 W. 19th St., Chicago, Ill.

**Cleartone Model 500; Model 700; Cleartone Regency Model.**

Manufacturer: American Sound Products, Inc., 2454 S. Michigan Ave.,  
Chicago 16, Ill.

**Dahlberg Model D-1; Dahlberg Junior Model D-2.**

Manufacturer: The Dahlberg Co., 2730 W. Lake St., Chicago 16, Ill.

**Dysonic Model 1.**

Manufacturer: Dynamic Hearing Aids, 43 Exchange Pl., New York 5,  
N. Y.

**Electroear Model C.**

Manufacturer: American Earphone Co., Inc., 10 East 43rd St., New  
York 17, N. Y.

**Gem Hearing Aid Model V-35; Gem Model V-60.**

Manufacturer: Gem Ear Phone Co., Inc., 50 W. 29th St., New York 1,  
N. Y.

**Maico UE-Atomeer; Maico Quiet Ear Models G and H; Maico  
Model J.**

Manufacturer: Maico Co., Inc., 21 North Third St., Minneapolis 1, Minn.

**Mears (Crystal and Magnetic) Aurophone Model 200; 1947—  
Mears Aurophone Model 98.**

**Manufacturer:** Mears Radio Hearing Device Corp., 1 W. 34th St., New York, N. Y.

**Micronic Model 303; Micronic Model "Mercury"; Micronic Star Model.**

**Manufacturer:** Micronic Co., 727 Atlantic Ave., Boston 11, Mass.

**Microtone T5 Audiomatic; Microtone Classic Model T9; Microtone Model T10; Microtone Model T612; Microtone Model 45.**

**Manufacturer:** Microtone Co., Ford Parkway on the Mississippi, St. Paul, Minn.; Minneapolis 9, Minn.

**National Cub Model C; National Cub Model D (Duplex);  
National Standard Model T; National Star Model S;  
National Ultrathin Model 504; National Vanity Model 506.**

**Manufacturer:** National Hearing Aid Laboratories, 815 S. Hill St., Los Angeles 14, Calif.

**Otarion Model E-4; Otarion Models F-1, F-2 and F-3; Otarion Model G-2; Otarion Model G-3.**

**Manufacturer:** Otarion Hearing Aids, 159 N. Dearborn St., Chicago, Ill.

**Paravox Model D, "Top-Twin-Tone"; Model J (Tiny-Mite);  
Paravox Model XT (Xtra-Thin); Paravox Model XTS  
(Xtra-Thin); Paravox Model Y (YM, YC and YC-7)  
(Veri-Small).**

**Manufacturer:** Paravox, Inc., 2056 E. 4th St., Cleveland, Ohio.

**Radioear Permo-Magnetic Multipower; Radioear Permo-Magnetic Uniphone; Radio Ear All Magnetic Model 55;  
Radioear Model 62 Starlet; Model 72.**

**Manufacturer:** E. A. Myers & Sons, 306 Beverly Rd., Mt. Lebanon, Pittsburgh, Pa.

**Rochester Model R-1; Rochester Model R-2.**

**Manufacturer:** Rochester Acoustical Laboratories, Inc., 117 Fourth St. S.W., Rochester, Minn.



**Silvertone Model 103BM.**

Manufacturer: National Hearing Aid Laboratories, 815 S. Hill St., Los Angeles 14, Calif.

Distributor: Sears-Roebuck & Co., 925 S. Homan Ave., Chicago 7, Ill.

**Silvertone Model J-92; Silvertone Model P-15.**

Manufacturer: W. E. Johnson Mfg. Co., 708 W. 40th St., Minneapolis, Minn.

Distributor: Sears, Roebuck & Co., 925 S. Homan Ave., Chicago 7, Ill.

**Solo-Pak Model 99.**

Manufacturer: Solo-Pak Electronics Corp., Linden St., Reading, Mass.

**Sonotone Model 700; Sonotone Model 900; Sonotone Models 910 and 920; Sonotone Model 925; Sonotone Model 940; Sonotone Model 966.**

Manufacturer: Sonotone Corp., Elmsford, N. Y.

**Superfonic Hearing Aid.**

Manufacturer: American Sound Products, Inc., 1303 S. Michigan Ave., Chicago 5, Ill.

**Televox Model E.**

Manufacturer: Televox Mfg. Co., 1307 Sansom St., Philadelphia 7, Pa.

**Telex Model 22; Telex Model 97; Telex Model 99; Telex Model 200; Telex Model 300B; Telex Model 400; Telex Model 500; Telex Model 1700.**

Manufacturer: Telex, Inc., Telex Park, Minneapolis 1, Minn.

**Tonamic Model 50.**

Manufacturer: Tonamic, Inc., 12 Russell St., Everett 49, Mass.

**Tonemaster Model Royal; Model Cameo.**

Manufacturer: Tonemasters, Inc., 400 S. Washington St., Peoria 2, Ill.

Unex Midget Model 95; Unex Midget Model 110; Unex Models 200 and 230.

Manufacturer: Nichols & Clark, Hathorne, Mass.

Vacolite Models J and J-2.

Manufacturer: Vacolite Co., 3003 N. Henderson St., Dallas 6, Tex.

Western Electric Models 65 and 66.

Manufacturer: Audivox, Inc., successor to Western Electric Hearing Aid Division, 259 W. 14th St., New York 11, N. Y.

Zenith Model 75; Zenith Miniature 75; Zenith Model Royal; Zenith Model Super Royal.

Manufacturer: Zenith Radio Corp., 6001 Dickens Ave., Chicago, Ill.

All of the accepted hearing devices employ vacuum tubes.

Accepted Hearing Aids more than five years old have been omitted from this list for brevity.

#### TABLE HEARING AIDS.

Aurex (Semi-Portable).

Manufacturer: Aurex Corp., 1117 N. Franklin St., Chicago 10, Ill.

Precision Table Hearing Aid.

Manufacturer: Precision Hearing Aids, 5157 W. Grand Ave., Chicago 39, Ill.

Sonotone Professional Table Set Model 50.

Manufacturer: Sonotone Corp., Elmsford, N. Y.

All of the Accepted hearing devices employ vacuum tubes.

## **DIRECTORY OF OTOLARYNGOLOGIC SOCIETIES.**

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### **AMERICAN OTOLOGICAL SOCIETY.**

President: Dr. Gordon D. Hoople, 1100 E. Genesee St., Syracuse, N. Y.  
Vice-President: Albert C. Furstenberg, University Hospital, Ann Arbor, Mich.  
Secretary: Dr. John R. Lindsay, 950 E. 59th St., Chicago 37, Ill.  
Meeting:

### **AMERICAN LARYNGOLOGICAL ASSOCIATION.**

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Secretary: Dr. Louis H. Clerf, 1530 Locust St., Philadelphia 2, Pa.  
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Meeting:

### **PUGET SOUND ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY.**

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Secretary: Dr. Willard F. Goff, 1215 Fourth Ave., Seattle, Wash.

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Meeting: Palmer House, Chicago, Ill., Oct. 12-17, 1952.

### **AMERICAN BOARD OF OTOLARYNGOLOGY.**

Meeting: Palmer House, Chicago, Ill., Oct. 6-10, 1952.

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Vice-Chairman: Dr. Irvin Feldman.

Secretary: Dr. Frasier Williams.

Treasurer: Dr. John Louzan.

Meetings are held on the third Tuesday of October, November, March  
and May, 7:00 P.M.

Place: Army and Navy Club, Washington, D. C.

**AMERICAN COLLEGE OF SURGEONS  
SCHEDULE OF SECTIONAL MEETINGS—1952**

The Vancouver Hotel, Vancouver, B. C., Monday, Tuesday, Wednesday,  
March 31, April 1, 2.

The Pioneer Hotel, Tucson, Ariz., Monday, Tuesday, Wednesday, April 7,  
8, 9.

Royal York Hotel, Toronto, Canada, Thursday, Friday, Saturday, May 15,  
16, 17.

Those who plan to attend a Sectional Meeting may select the meeting  
which in time or place is most convenient.

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AND OTOLARYNGOLOGICAL SOCIETY.**

President: Dr. William B. Clark, 211 Loyola Ave., New Orleans, La.

Vice-President: Dr. W. L. Hughes, Lamar Life Bldg., Jackson, Miss.

Secretary: Dr. Edley H. Jones, 1301 Washington St., Vicksburg, Miss.

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Meeting: Palmer House, Chicago, Ill., Oct. 11, 1952.

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President-Elect: Dr. Kenneth L. Craft, Indianapolis, Ind.

Secretary-Treasurer: Dr. Joseph Hampsey, 806 May Bldg., Pittsburgh 22,  
Pa.

Meeting: Palmer House, Chicago, Ill., Oct. 17, 1952.

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Executive Secretary: Dr. Chevalier L. Jackson, 1901 Walnut St., Phila-  
delphia 3, Pa., U. S. A.

Meeting: Fourth Pan American Congress of Oto-Rhino-Laryngology and  
Broncho-Esophagology.

President: Dr. Ricardo Tapia Acuna, Mexico City.

Time and Place: January, 1954, Mexico City.

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For Otolaryngology, Charlottesville, Va., Nov. 21-22, 1952.  
Spring Meeting: Hot Springs, Va., May, 1953.

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Recording Secretary, E. N. T. Section: Dr. Donald B. Hull.  
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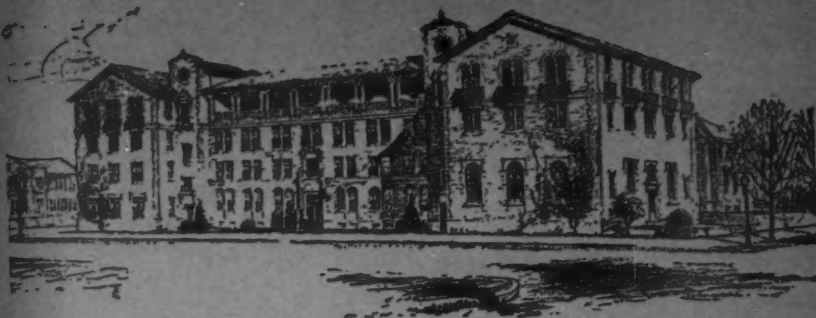
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# Central Institute for the Deaf

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Approved by Advisory Council of Foremost Ear Specialists and Educators

New fire-proof buildings beautifully located opposite Forest Park. Modern Dormitories and Equipment. Best home environments. Pupils constantly in care of teachers or experienced supervisors.

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C. I. D. offers all advantages of exclusively Speech Training and expert medical supervision for both Resident and Day Pupils.

Nursery School (2 years of age) through the Elementary Grades.

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Salvaging of Residual Hearing is a specialty of C. I. D. The Acoustic Method was created here. Group and individual hearing aids used for class instruction at all grade levels.

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Private and Class Instruction for Hard-of-Hearing Adults and Children.  
Conversational Classes for advanced pupils. Speech conservation stressed.

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Private and Class Instruction for children with normal hearing and delayed speech or defective speech.

Resident and Day Pupils (2 years of age through Elementary Grades).

Private Instruction for Adults.

Correction of Imperfect Phonation, Imperfect Articulation, Aphasia, Stuttering.

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Two years of Training following a professional curriculum for applicants with adequate college qualifications. Graduates qualify for degrees of Bachelor of Science in Education or Master of Science in Education from Washington University. Graduates prepared to teach both the deaf and speech defective.

DR. MAX A. GOLDSTEIN, Founder

DR. HELEN SCHICK LANE, Principal

**818 S. KINGSHIGHWAY 10, ST. LOUIS, MO.**

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